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ATTENUATION OF LIGHT TRANSMISSION IN ARMY AIRCRAFT TRANSPARENCIES DUE TO SLANTING

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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

The rates of light transmission reduction due to the slanting in eight fixed wing and fourteen rotary wing aircraft transparencies have been examined. We found that the optical quality at various portions of the UH-1 transparencies and all the fixed wing samples possess similar characteristics of transmission reduction. The windscreen and the armor glass of CH-54 samples are similar too. But the tinted versus the clear AH-1G transparencies are quite different. The tinted sample generally has 27% spectral transmission loss compared to that of

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SUMMARY

The rates of light transmission reduction due to the slanting in eight fixed wing and fourteen rotary wing aircraft transparencies have been examined. We found that the optical quality at various portions of the UH-1 transparencies and all the fixed wing samples possess similar characteristics of transmission reduction. The windscreen and the armor glass of CH-54 samples are similar too. But the tinted versus the clear AH-1G transparencies are quite different. The tinted sample generally has 27% spectral transmission loss compared to that of the clear sample. This reduction could constitute a dangerous loss of visibility for the aviator, especially during periods of reduced illumination and at night. The results presented in this study enable the potential users of the optical as well as the electro-optical devices to compute the amount of transmission reduction in most of the current Army aircraft.

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INTRODUCTION

Most aircraft windscreens are designed to match the contour of the mainframe because of aerodynamic considerations. A slanting windshield not only possesses its inherent optical distortions, but also causes prismatic displacement as well as a loss in light transmission. Investigators in US Air Force Laboratories[1,2,3] have quite extensively conducted research in these areas. For example, Grether[1] has studied the effect of slope and windscreen upon the optical degradation of pilot vision in the forward direction.

In surveying the literature, one notices that most distortion and transmission reduction studies were done on high-speed aircraft windshields. Recently, several optical and spectral transmission studies on low-speed fixed and rotary wing Army aircraft windshields have been reported by us[4,5]. Furthermore, we also measured several samples for attenuation of light transmission due to slanting[6]. This study continues the same subject with eight fixed wing and fourteen rotary wing aircraft windshield samples. The transparencies from one of the rotary wing aircraft (UH-1) have been studied in detail. The samples have been prepared from the center, the corner, the side portions of the windshield as well as from the crew door, the sliding door and the fixed portion of the door. Results from these particular cross-sectional analyses enable potential users of optical and the electro-optical devices to compute the amount of transmission reduction from almost all the transparent portions of the UH-1 aircraft.

METHODOLOGY

a. Samples

Eight fixed wing and fourteen rotary wing aircraft windscreen samples are labeled in Tables A and B respectively. All the samples were cut into 2" X 2" squares except the sample of U-8D/U-8F where the whole windshield was used.

b. Apparatus:

Model 1980, Spectra Pritchard Photometer was used to measure the light transmission. A supporting device, calibrated in one degree increments in both the horizontal and vertical planes, was used to position and rotate the test samples through an angular range of 0° - 90°. A Macbeth Quantalog Transmission Densitometer was employed to read the transmission of some samples at 0° angle only. The light source was a Spectra Regulated Brightness Source (9 ft.L).

c. Procedure

The equipment was aligned along a horizontal axis running from the central aperture opening in the photometer detector head and through the centers of the sample and brightness source screen. After this alignment procedure was completed, and after the photometric equipment was internally calibrated, the transmission measurements were then taken.

d. Design

The light source on the jack was placed 28" in front of the photometer detector head. The sample held by the supporting device was centered between the light source and the photometer. In this case, the supporting device was designed to allow us to accurately simulate any angle of inclination likely to be encountered in the aircraft.

RESULTS AND DISCUSSION

Results are shown in Tables F1 to F8 and R1 to R14 and their respective figures. The average values for an incident angle normal to the vertical position of the sample varied from 60% to 95%. The light transmissions due to slanting of the samples were expected to decrease. The rate of loss gradually increases up to approximately 50° within 5% at each level while the increases of the rate of loss is comparatively less up to 50°. Generally we find that the rate does not exceed 25% for any of the test samples at 60° except CH-47 and AH-1G.

At the range beyond 60°, the rate of attenuation is increasing rapidly. This may be beyond the aviator's concern because incident angles of an aviator's vision relative to the position of the windscreen would rarely exceed 60° during the actual course of flying. The attenuation is caused by light scattering, reflection, and refraction from the front and the back surface of the windscreen material. Furthermore, the degree of polarization affects the amplitude of the electric field. When the angle reaches the Brewster angle, the light is totally plane polarized. Thus one of its electric field component vanishes. The light transmission thus reduces. The Brewster angle is dependent upon the refractive indices of the material.

CONCLUSION

In conclusion, we have examined the rates of the transmission reduction of eight fixed wing and fourteen rotary wing aircraft transparencies. The results are summarized in Tables A and B respectively for fixed wing and rotary wing aircraft transparencies. The transmission reduction occurs gradually as the slanting angle approaches 60°.

From various portions of UH-1 samples, the transmission reduction throughout the measuring range possesses more or less common characteristics. In other words, the optical quality of the windshield transparencies are almost the same for all the UH-1 samples and for all the fixed wing samples. The same is true for the CH-54 windshield transparency with respect to its armor glass sample. However, in AH-1G transparencies, the tinted sample has an average 25% transmission reduction with respect to its clear transparency. The problem of this unnecessary reduction has been pointed out by Crosley7 and by one of us[4] previously. This reduction could constitute a dangerous loss of visibility for the aviator, especially during periods of reduced illumination and at night. In summary, the results presented in this report enable the potential users of the optical and the electro-optical devices to compute the amount of transmission reduction due to slanting.

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TABLE A

RATE OF ATTENUATION IN LIGHT TRANSMISSION (%)
OF FIXED WING AIRCRAFT

Aircraft	10°	20°	30°	40°	50°	60°	70°	80°	90°
U-6A	0.5	0.7	1.1	1.7	3.2	7.7	19.9	62.0	100.0
U-8D/U-8F	1.1	2.2	3.3	5.1	8.5	15.0	26.5	---	------
T-41	0.4	1.3	2.6	4.5	8.0	14.5	28.5	67.4	100.0
T-42/U-8	1.1	1.7	2.4	3.7	6.4	12.3	27.5	79.5	100.0
CV-2	0.0	0.4	1.2	2.6	5.4	11.6	25.3	55.2	100.0
CV-7	0.1	0.4	1.1	2.4	5.1	11.1	24.8	54.6	100.0
0-1	3.0	6.0	8.0	9.0	11.0	16.0	23.0	24.0	100.0
OV-1	2.0	5.0	7.0	10.0	14.0	22.0	31.0	35.0	100.0

TABLE B

RATE OF ATTENUATION IN LIGHT TRANSMISSION (%)
OF ROTARY WING AIRCRAFT

Aircraft	10°	20°	30°	40°	50°	60°	70°	80°	90°
OH-58	0.2	0.4	0.9	2.1	4.2	9.7	22.4	63.1	100.0
TH-55/OH-6A	0.7	0.9	1.3	2.4	4.8	10.3	23.8	63.5	100.0
CH-47	3.0	7.0	11.0	14.0	19.0	27.0	36.0	38.0	100.0
CH-54	3.0	5.0	7.0	7.0	8.0	12.0	20.0	23.0	100.0
CH-54 (Armor Glass)	4.0	6.0	8.0	9.0	11.0	15.0	20.0	20.0	100.0
AH-1G	1.0	4.0	6.0	8.0	11.0	20.0	31.0	38.0	100.0
AH-1G (Tinted)	3.0	6.0	10.0	14.0	18.0	27.0	32.0	35.0	100.0
UH-1D	0.5	0.9	1.5	2.5	4.8	10.1	23.3	76.9	100.0
UH-1 (Center)	2.0	5.0	8.0	11.0	16.0	24.0	32.0	40.0	100.0
UH-1 (Corner)	2.0	4.0	7.0	9.0	14.0	25.0	37.0	41.0	100.0
UH-1 (Back)	3.0	6.0	8.0	10.0	11.0	17.0	25.0	27.0	100.0
UH-1 (Crew Door)	3.0	6.0	8.0	9.0	13.0	18.0	24.0	25.0	100.0
UH-1 (Sliding Section)	3.0	6.0	11.0	14.0	22.0	31.0	31.0	31.0	100.0
UH-1 Door (Fixed Portion)	3.0	6.0	8.0	10.0	12.0	17.0	23.0	26.0	100.0

TABLE F1

Aircraft: DeHavilland U-6A (Beaver)

Angle of Inclination (°)	Transmission (%) Sample 1	Sample 2	Sample 3	Average
0	96.2	94.4	93.6	94.73
5	95.7	94.0	93.5	94.40
10	95.5	93.9	93.4	94.27
15	95.3	93.6	93.4	94.10
20	95.1	93.6	93.4	94.03
25	94.8	93.3	93.3	93.80
30	94.7	93.1	93.3	93.70
35	94.5	92.8	93.2	93.50
40	93.9	92.5	92.9	93.10
45	93.5	91.8	92.6	92.63
50	92.6	90.6	91.8	91.67
55	91.2	88.7	90.0	89.07
60	88.5	85.8	88.0	87.43
65	84.3	81.5	83.0	82.93
70	77.0	74.3	76.3	75.87
75	67.0	58.0	57.4	60.80
80	48.5	30.2	29.4	36.03
85	16.7	10.0	8.8	11.83
90	0.0	0.0	0.0	0.0

TABLE F2

Aircraft: Beech U-8D/U-8F

Angle of Inclination (^{o})	Transmission (%) Sample 1	Sample 2	Sample 3	Average
0	89.2	88.0	89.0	88.73
5	88.7	87.7	88.2	88.20
10	88.4	87.2	87.7	87.77
15	88.1	86.8	86.9	87.27
20	87.9	86.5	86.0	86.80
25	87.5	86.1	85.3	86.30
30	87.0	85.7	84.7	85.80
35	86.4	85.0	84.0	85.13
40	85.6	84.0	83.1	84.23
45	84.5	82.9	81.6	83.00
50	82.9	81.4	79.3	81.20
55	80.9	78.9	76.4	78.73
60	77.6	75.7	73.0	75.43
65	73.2	70.7	68.9	70.93
70	66.5	63.6	65.5	65.20

NOTE: In this case, the whole windscreen had to be tested. However, due to the double curvature of the windscreen, angles greater than 70^{o} could not be measured.

TABLE F3

Aircraft: Cessna T-41

Angle of Inclination (°)	Transmission (%) Sample 1	Sample 2	Sample 3	Average
0	74.7	74.5	73.8	74.33
5	74.5	74.3	73.6	74.13
10	74.3	74.2	73.5	74.00
15	74.0	73.8	73.0	73.60
20	73.9	73.4	72.8	73.37
25	73.6	72.9	72.6	73.03
30	72.9	72.4	72.0	72.43
35	72.4	71.6	71.5	71.83
40	71.4	70.9	70.7	71.00
45	70.3	69.8	69.6	69.90
50	69.0	68.2	68.0	68.40
55	66.8	66.3	66.2	66.43
60	64.0	63.2	63.5	63.57
65	59.6	59.1	59.1	59.27
70	53.7	52.8	53.0	53.17
75	36.3	36.0	35.7	36.00
80	24.5	23.5	24.7	24.23
85	22.5	22.8	22.3	22.53
90	0.0	0.0	0.0	0.0

TABLE F4

Aircraft: Beech T-42/U-8

Angle of Inclination (°)	Transmission (%)			
	Sample 1	Sample 2	Sample 3	Average
0	93.3	92.4	91.3	92.53
5	92.8	91.9	90.9	91.87
10	92.6	91.6	90.4	91.53
15	92.2	91.4	90.1	91.23
20	92.0	91.0	89.8	90.93
25	91.7	90.9	89.4	90.67
30	91.3	90.4	89.1	90.27
35	90.7	89.9	88.6	89.73
40	90.1	89.3	87.8	89.07
45	89.0	88.3	87.0	88.10
50	87.6	86.8	85.4	86.60
55	85.5	84.7	83.2	84.47
60	81.9	81.5	80.0	81.13
65	77.0	76.4	75.2	76.20
70	66.1	68.2	67.0	67.10
75	36.0	39.4	35.6	37.00
80	17.8	20.2	19.0	19.00
85	9.5	8.4	11.3	9.73
90	0.0	0.0	0.0	0.0

TABLE F5

Aircraft: DeHavilland CV-2 (Caribou)

Angle of Inclination (^{o})	Transmission (%)
0	77.9
10	77.9
20	77.6
30	77.0
40	75.9
50	73.7
60	68.9
70	58.2
80	34.9
90	0.0

NOTE: Data were supplied by the manufacturer.

TABLE F6

Aircraft: DeHavilland CV-7 (Buffalo)

Angle of Inclination (^{o})	Transmission (%)
0	80.0
10	79.9
20	79.7
30	79.1
40	78.1
50	75.9
60	71.1
70	60.2
80	36.3
90	0.0

NOTE: Data were supplied by the manufacturer.

TABLE F7

Aircraft: 0-1 (Back)

Angle of Inclination (^{o})	Sample 1	Sample 2	Sample 3	Average	Transmission (%)
0	5.89	6.07	5.90	5.95	93
10	5.70	5.88	5.69	5.76	90
20	5.56	5.72	5.55	5.61	88
30	5.44	5.63	5.43	5.50	86
40	5.38	5.56	5.34	5.43	85
50	5.25	5.48	5.22	5.32	83
60	4.91	5.19	4.93	5.01	78
70	4.46	4.87	4.51	4.61	72
80	4.31	4.87	4.37	4.52	36
90	0	0	0	0	0

TABLE F8

Aircraft: OV-1

Angle of Inclination (^{o})	Sample 1	Sample 2	Sample 3	Average	Transmission (%)
0	5.60	5.61	5.62	5.61	91
10	5.50	5.48	5.47	5.48	89
20	5.33	5.33	5.34	5.33	87
30	5.20	5.22	5.21	5.21	85
40	5.05	5.09	5.05	5.06	82
50	4.85	4.91	4.80	4.85	79
60	4.38	4.40	4.30	4.36	71
70	3.96	3.92	3.73	3.87	63
80	3.83	3.67	3.36	3.62	59
90	0	0	0	0	0

TABLE R1

Aircraft: Bell OH-58

Angle of Inclination (°)	Transmission (%) Sample 1	Sample 2	Sample 3	Average
0	90.6	89.3	89.9	89.93
5	90.6	89.2	89.7	89.83
10	90.4	89.2	89.6	89.77
15	90.4	89.0	89.5	89.63
20	90.3	88.9	89.5	89.57
25	90.2	88.6	89.3	89.37
30	90.1	88.3	89.0	89.13
35	89.8	87.7	88.7	88.73
40	89.2	87.1	88.2	88.00
45	88.5	86.3	87.4	87.40
50	87.3	84.8	86.3	86.13
55	85.5	82.9	84.4	84.27
60	82.5	79.6	81.5	81.20
65	78.2	74.8	77.3	76.77
70	71.4	67.8	70.1	69.77
75	49.6	46.0	49.3	48.30
80	34.6	31.2	33.7	33.17
85	26.1	22.6	24.8	24.50
90	0.0	0.0	0.0	0.0

TABLE R2

Aircraft: Hughes TH-55/OH-6A

Angle of Inclination (°)	Transmission (%) Sample 1	Sample 2	Sample 3	Average
0	93.1	91.3	91.3	91.90
5	92.5	91.1	91.0	91.53
10	92.1	91.0	90.7	91.27
15	91.9	91.0	90.6	91.17
20	91.8	90.9	90.5	91.07
25	91.4	90.7	90.4	90.83
30	91.3	90.5	90.2	90.67
35	90.9	90.3	89.9	90.37
40	90.3	89.6	89.3	89.73
45	89.5	88.7	88.5	88.90
50	88.0	87.3	87.3	87.53
55	86.1	85.3	85.6	85.67
60	82.5	82.2	82.5	82.40
65	77.6	77.0	77.8	77.47
70	70.1	69.3	70.6	70.00
75	48.0	48.2	49.5	48.57
80	31.5	32.9	36.2	33.53
85	29.8	27.3	23.1	26.73
90	0.0	0.0	0.0	0.0

TABLE R3

Aircraft: CH-47

Angle of Inclination (^{o})	Sample 1	Sample 2	Sample 3	Average	Transmission (%)
0	4.71	4.39	4.68	4.59	74
10	4.53	4.23	4.53	4.43	71
20	4.42	4.01	4.36	4.26	69
30	4.30	3.82	4.19	4.10	66
40	4.14	3.67	3.99	3.93	63
50	3.91	3.50	3.72	3.71	60
60	3.46	3.26	3.34	3.35	54
70	3.01	2.84	3.01	2.95	48
80	2.95	2.63	3.00	2.86	46
90	0	0	0	0	0

TABLE R4

Aircraft: CH-54

Angle of Inclination (^{o})	Sample 1	Sample 2	Sample 3	Average	Transmission (%)
0	6.12	6.20	6.19	6.17	95
10	5.98	5.96	5.94	5.96	92
20	5.85	5.83	5.81	5.83	90
30	5.76	5.76	5.75	5.76	89
40	5.74	5.74	5.72	5.73	88
50	5.69	5.70	5.68	5.69	88
60	5.42	5.41	5.47	5.43	84
70	5.01	4.95	4.92	4.96	76
80	4.87	4.75	4.63	4.75	73
90	0	0	0	0	0

TABLE R5

Aircraft: CH-54 (Armor Glass)

Angle of Inclination (°)	Sample 1	Sample 2	Sample 3	Average	Transmission (%)
0	6.03	6.04	6.03	6.03	95
10	5.81	5.81	5.80	5.81	92
20	5.64	5.65	5.64	5.64	89
30	5.57	5.56	5.55	5.56	88
40	5.49	5.50	5.46	5.48	86
50	5.41	5.40	5.35	5.39	85
60	5.20	5.16	5.10	5.15	81
70	4.88	4.83	4.82	4.84	76
80	4.82	4.82	4.76	4.80	75
90	0	0	0	0	0

TABLE R6

Aircraft: AH-1G

Angle of Inclination (^{o})	Sample 1	Sample 2	Sample 3	Average	Transmission (%)
0	5.40	5.51	5.55	5.49	90
10	5.39	5.45	5.51	5.45	89
20	5.20	5.30	5.36	5.29	87
30	5.09	5.20	5.23	5.17	85
40	4.97	5.11	5.11	5.06	83
50	4.79	4.91	4.95	4.88	80
60	4.24	4.40	4.52	4.39	72
70	3.67	3.82	3.81	3.77	62
80	3.39	3.40	3.44	3.41	56
90	0	0	0	0	0

TABLE R7

Aircraft: AH-1G (Tinted)

Angle of Inclination (°)	Sample 1	Sample 2	Sample 3	Average	Transmission (%)
0	4.32	4.19	4.14	4.22	68
10	4.22	4.05	4.02	4.10	66
20	4.05	3.92	3.88	3.95	64
30	3.93	3.76	3.74	3.81	61
40	3.79	3.60	3.56	3.65	59
50	3.62	3.38	3.32	3.44	55
60	3.28	3.01	2.94	3.08	50
70	3.09	2.72	2.75	2.85	46
80	2.80	2.72	2.73	2.75	44
90	0	0	0	0	0

TABLE R8

Aircraft: Bell UH-1D (Iroquois)

Angle of Inclination (°)	Transmission (%) Sample 1	Sample 2	Sample 3	Average
0	93.4	94.0	92.6	93.33
5	93.2	93.6	92.3	93.03
10	93.0	93.5	92.2	92.90
15	92.9	93.2	92.1	92.73
20	92.7	92.8	92.0	92.50
25	92.5	92.5	91.8	92.27
30	92.0	92.3	91.5	91.93
35	91.6	91.8	91.2	91.53
40	91.2	91.3	90.6	91.03
45	90.4	90.4	89.7	90.17
50	88.8	89.1	88.6	88.83
55	86.8	87.1	86.7	86.87
60	83.5	84.2	84.0	83.90
65	78.7	79.6	79.4	79.23
70	70.7	71.8	72.3	71.60
75	48.1	52.0	53.1	51.07
80	18.6	23.2	23.0	21.60
85	6.5	7.6	9.5	7.87
90	0.0	0.0	0.0	0.0

TABLE R9

Aircraft: UH-1 (Center)

Angle of Inclination (^{o})	Sample 1	Sample 2	Sample 3	Average	Transmission (%)
0	5.71	5.67	5.69	5.69	92
10	5.58	5.51	5.55	5.55	90
20	5.44	5.38	5.38	5.40	87
30	5.33	5.26	5.19	5.26	85
40	5.20	5.13	4.94	5.09	82
50	4.91	4.81	4.67	4.80	78
60	4.46	4.22	4.26	4.31	70
70	3.98	3.71	3.88	3.86	62
80	3.56	3.26	3.46	3.41	55
90	0	0	0	0	0

TABLE R10

Aircraft: UH-1 (Corner)

Angle of Inclination (°)	Sample 1	Sample 2	Sample 3	Average	Transmission (%)
0	5.49	5.54	5.64	5.56	91
10	5.36	5.44	5.50	5.43	89
20	5.24	5.29	5.40	5.31	87
30	5.10	5.16	5.28	5.18	85
40	4.97	5.07	5.15	5.06	83
50	4.56	4.82	4.94	4.77	78
60	3.90	4.19	4.41	4.17	68
70	3.38	3.61	3.58	3.52	58
80	3.29	3.34	3.23	3.29	54
90	0	0	0	0	0

TABLE R11

Aircraft: UH-1 (Back)

Angle of Inclination (^{o})	Sample 1	Sample 2	Sample 3	Average	Transmission (%)
0	5.74	5.74	5.71	5.73	92
10	5.55	5.55	5.53	5.54	89
20	5.41	5.41	5.39	5.40	87
30	5.28	5.28	5.27	5.28	85
40	5.18	5.20	5.17	5.18	83
50	5.06	5.11	5.06	5.08	82
60	4.79	4.72	4.73	4.75	76
70	4.40	4.13	4.29	4.27	69
80	4.32	4.00	4.25	4.19	67
90	0	0	0	0	0

TABLE R12

Aircraft: UH-1 (Crew Door)

Angle of Inclination (^{o})	Sample 1	Sample 2	Sample 3	Average	Transmission (%)
0	5.69	5.68	5.60	5.66	91
10	5.55	5.52	5.46	5.51	89
20	5.40	5.35	5.27	5.34	86
30	5.29	5.22	5.09	5.20	84
40	5.21	5.11	5.01	5.11	82
50	5.13	4.93	4.72	4.93	79
60	4.79	4.63	4.47	4.63	74
70	4.36	4.23	4.28	4.29	69
80	4.27	4.14	4.26	4.22	68
90	0	0	0	0	0

TABLE R13

Aircraft: UH-1 (Sliding Section)

Angle of Inclination (^{o})	Sample 1	Sample 2	Sample 3	Average	Transmission (%)
0	5.79	5.59	5.79	5.79	92
10	5.62	5.40	5.61	5.54	89
20	5.43	5.25	5.44	5.37	86
30	5.30	5.12	5.29	5.24	84
40	5.17	5.00	5.17	5.11	82
50	5.00	4.81	4.93	4.91	79
60	4.59	4.37	4.43	4.46	72
70	4.10	3.88	3.89	3.96	64
80	4.08	3.86	3.88	3.94	63
90	0	0	0	0	0

TABLE R14

Aircraft: UH-1 (Door Fixed Position)

Angle of Inclination (^{o})	Sample 1	Sample 2	Sample 3	Average	Transmission (%)
0	5.60	5.60	5.51	5.57	91
10	5.46	5.44	5.33	5.41	88
20	5.29	5.27	5.16	5.24	86
30	5.16	5.14	5.04	5.11	83
40	5.06	5.05	4.96	5.02	82
50	4.95	4.93	4.84	4.91	80
60	4.72	4.64	4.54	4.63	76
70	4.49	4.20	4.22	4.30	70
80	4.43	4.11	4.19	4.24	69
90	0	0	0	0	0

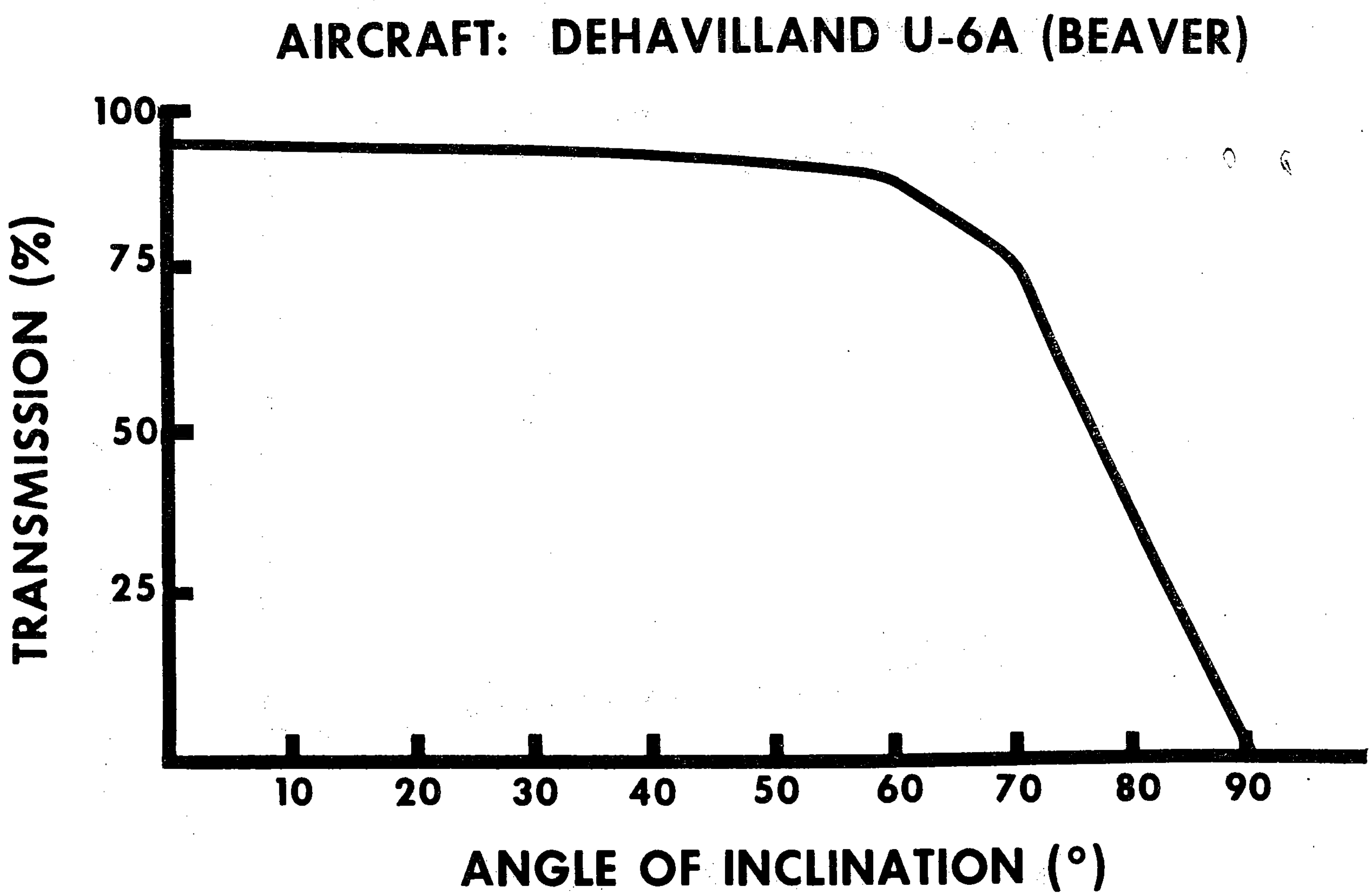

AIRCRAFT: DEHAVILLAND U-6A (BEAVER)
TRANSMISSION (%)
100
75
50
25
10
20
30
40
50
60
70
80
90
ANGLE OF INCLINATION (°)

FIGURE F1

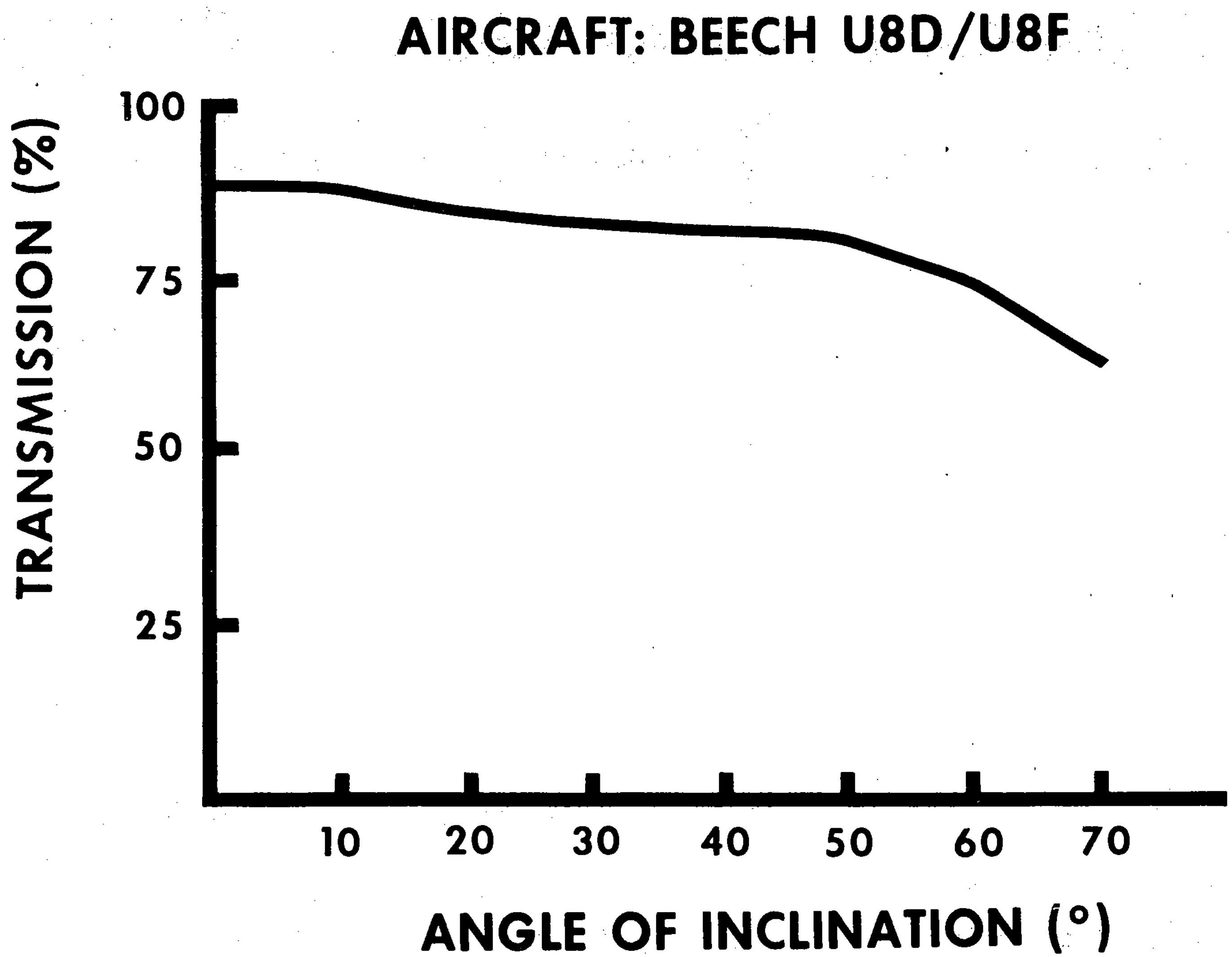
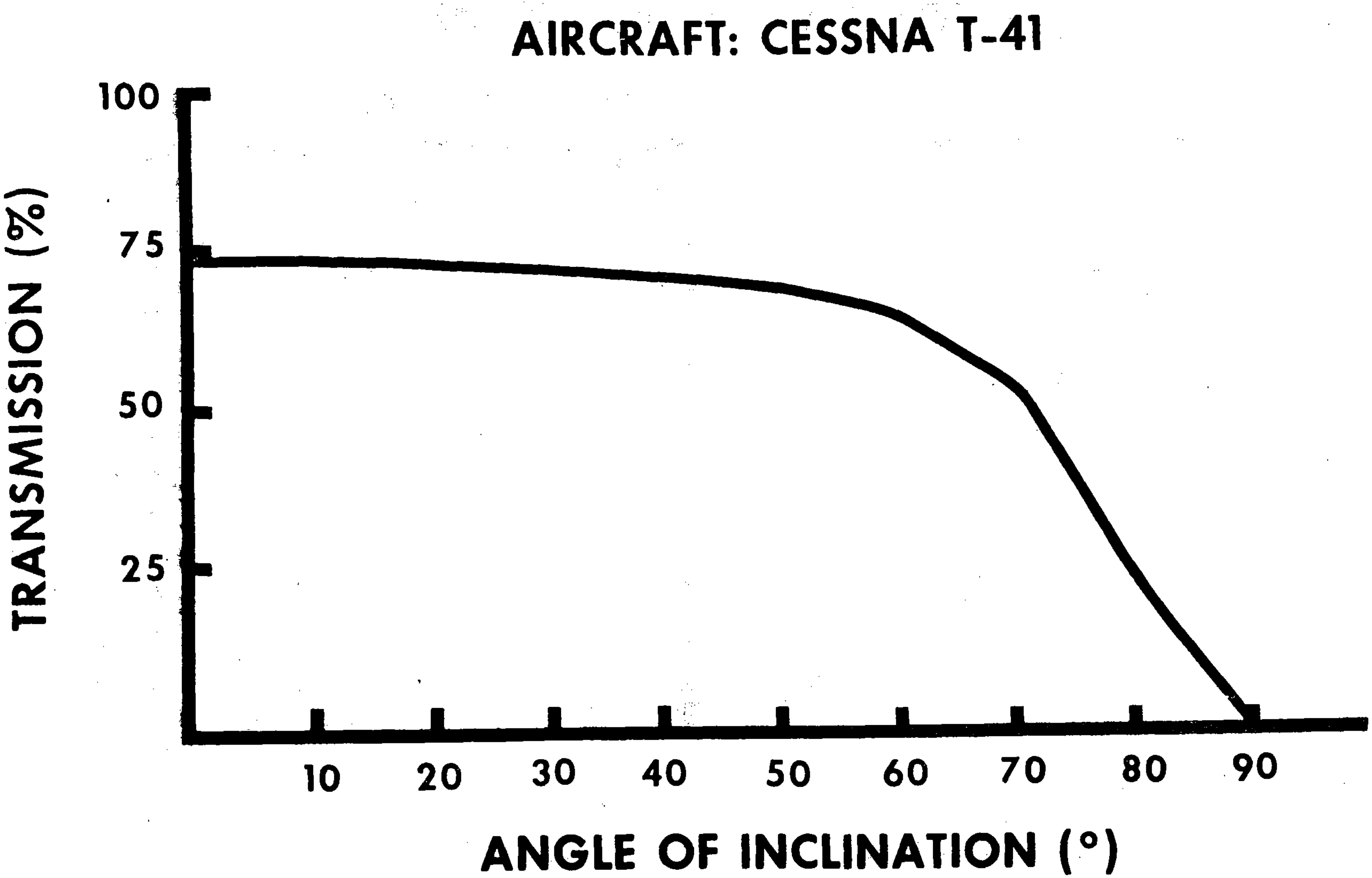
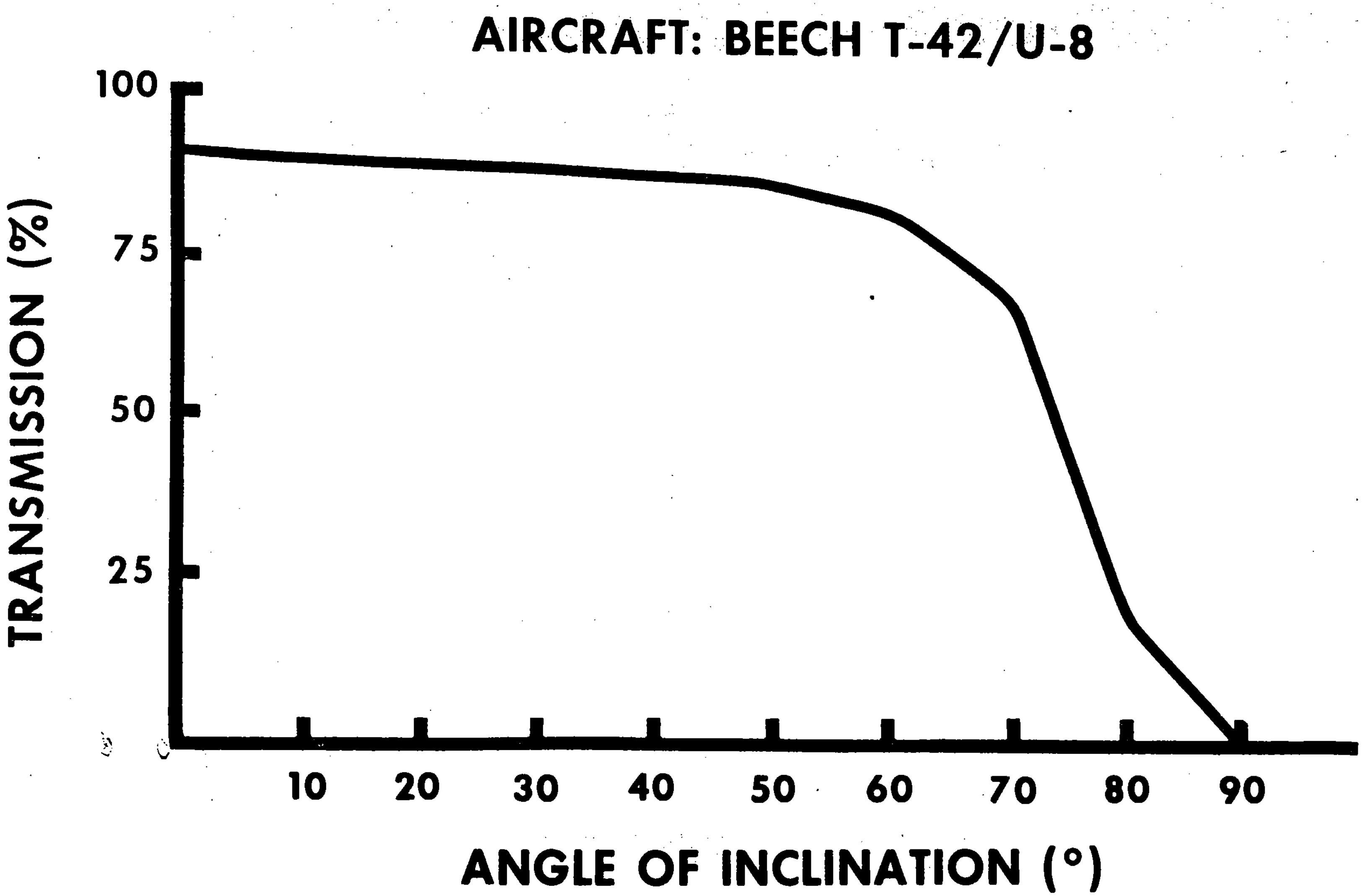

AIRCRAFT: BEECH U8D/U8F
TRANSMISSION (%)
100
75
50
25
10
20
30
40
50
60
70
ANGLE OF INCLINATION (°)

FIGURE F2


AIRCRAFT: CESSNA T-41
100
75
50
25
TRANSMISSION (%)
10
20
30
40
50
60
70
80
90
ANGLE OF INCLINATION (°)
FIGURE F3


AIRCRAFT: BEECH T-42/U-8
TRANSMISSION (%)
100
75
50
25
0
10
20
30
40
50
60
70
80
90
ANGLE OF INCLINATION (°)
FIGURE F4

AIRCRAFT : DeHAVILLAND CV-2 (CARIBOU)

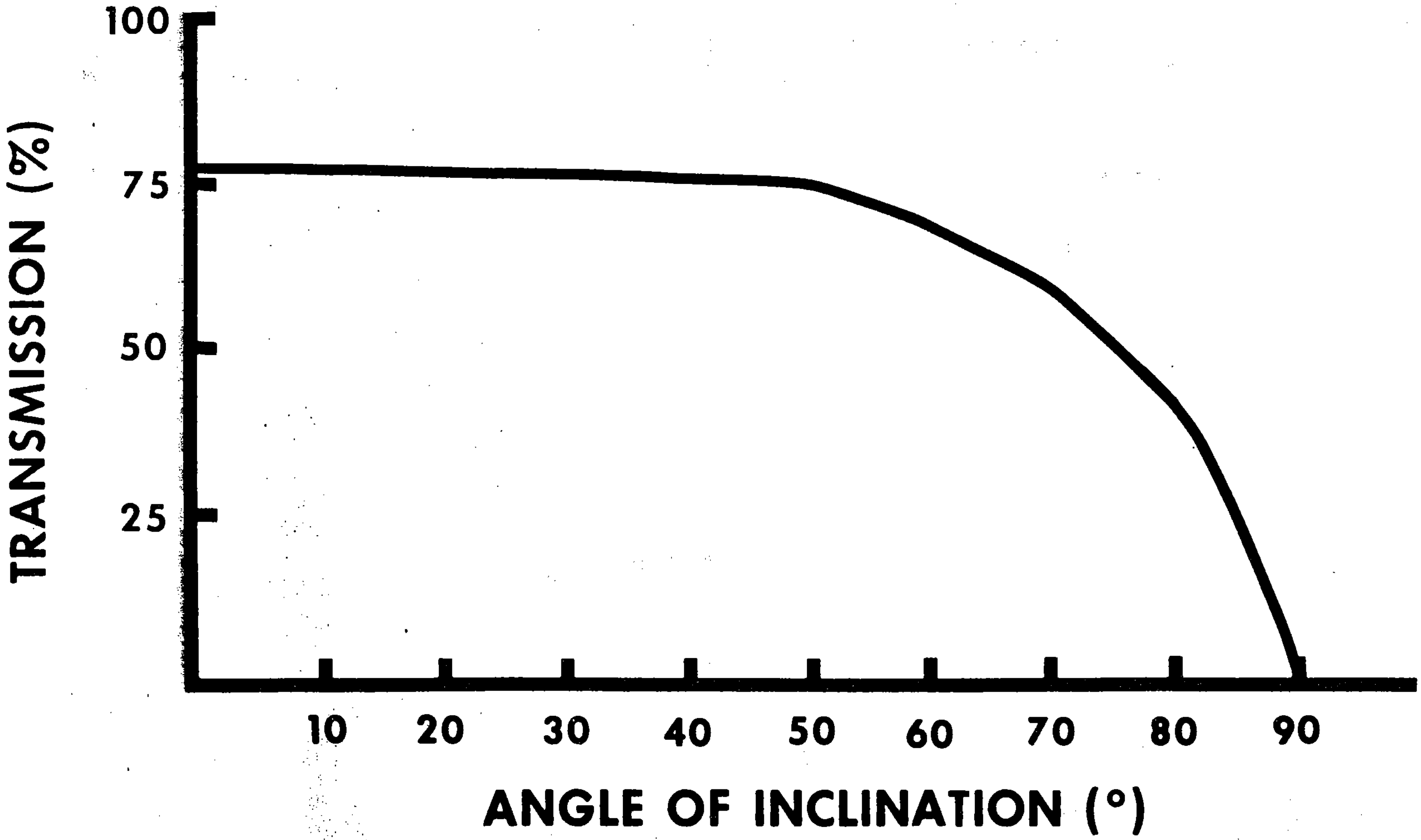


FIGURE F5

DeHAVILLAND AIRCRAFT: DeHAVILLAND CV-7 (BUFFALO)

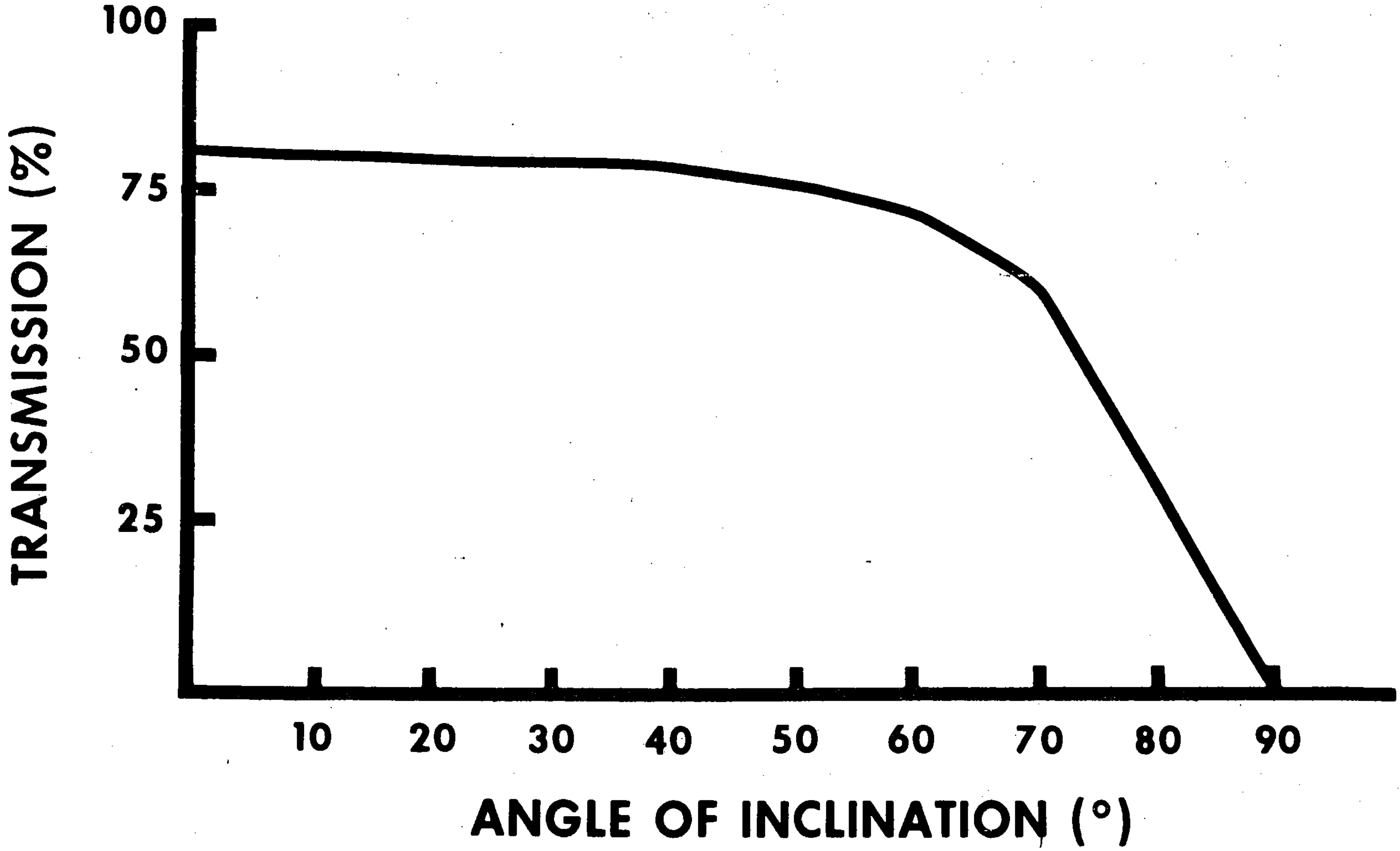


FIGURE F6

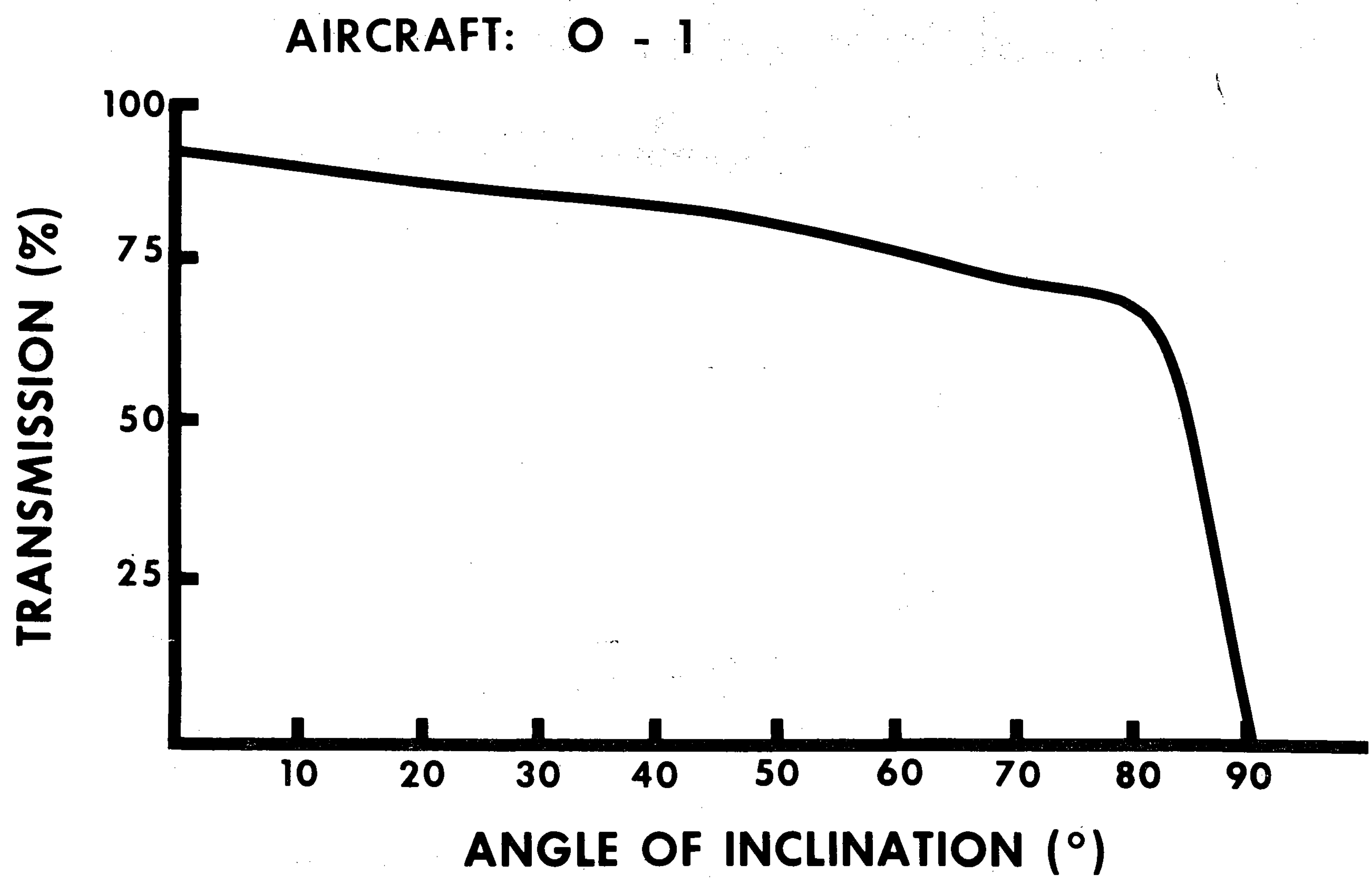

AIRCRAFT: O - 1
TRANSMISSION (%)
100
75
50
25
10
20
30
40
50
60
70
80
90
ANGLE OF INCLINATION (°)

FIGURE F7

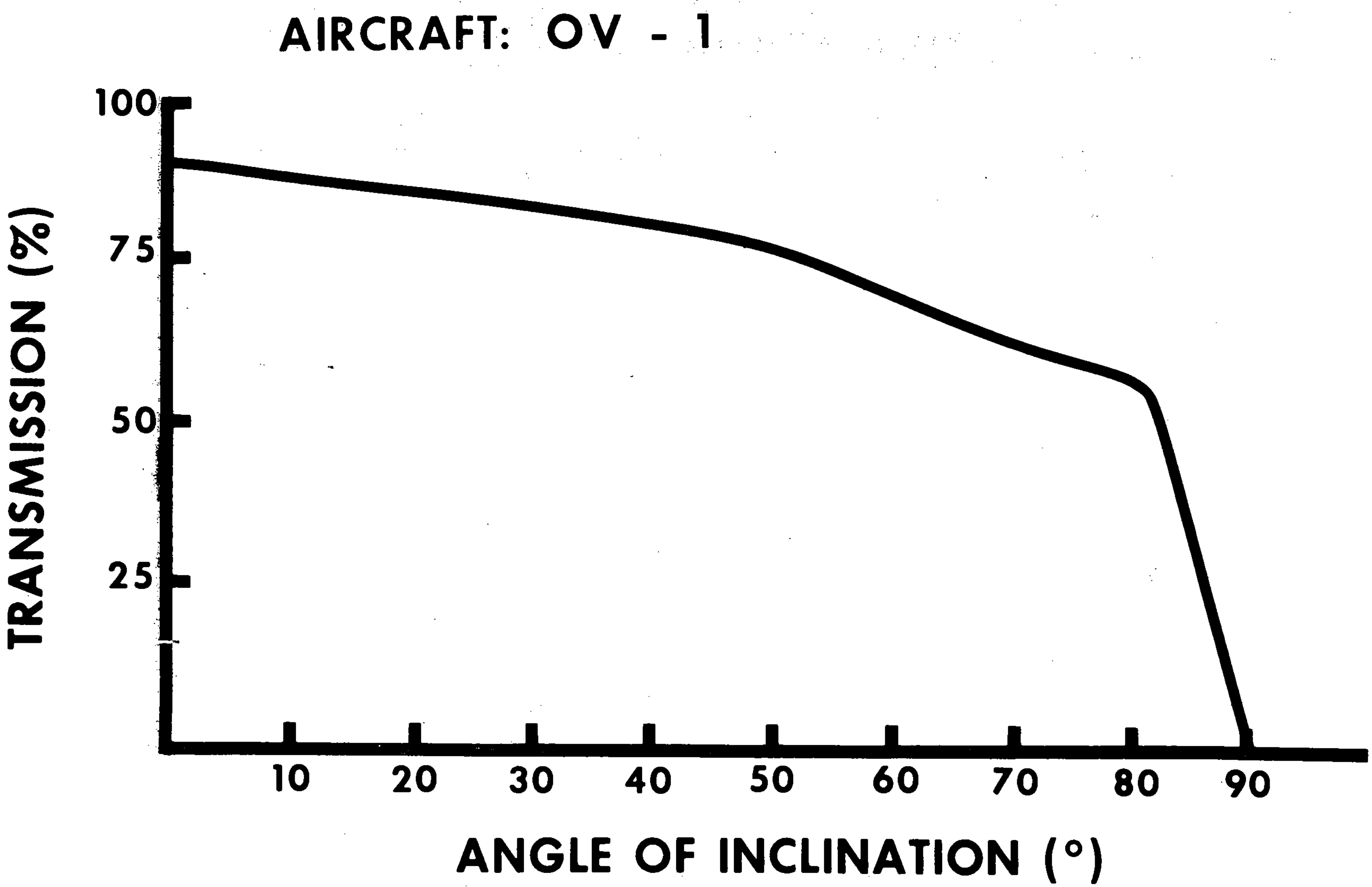
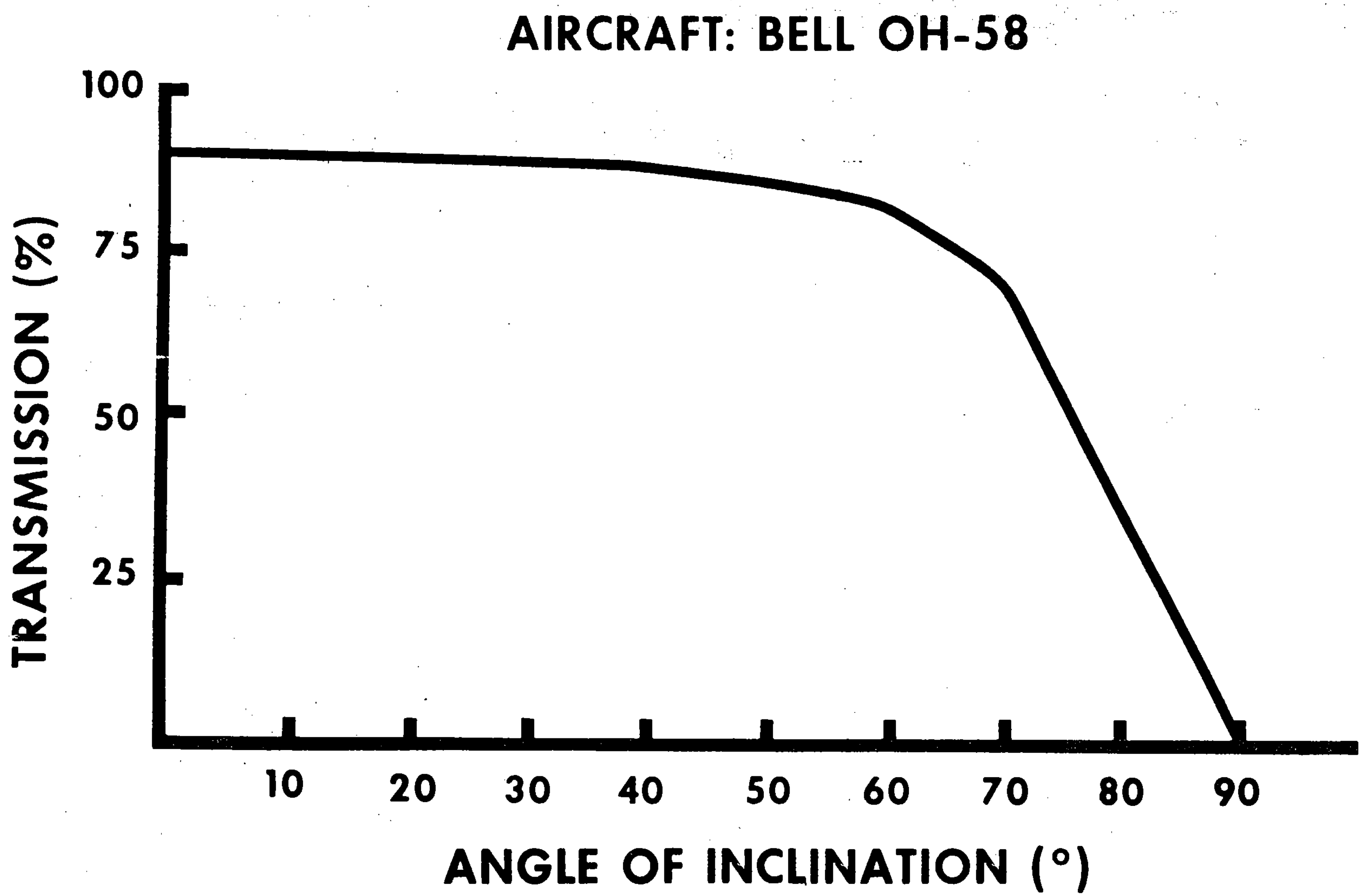

AIRCRAFT: OV - 1
100
75
50
25
TRANSMISSION (%)
10
20
30
40
50
60
70
80
90
ANGLE OF INCLINATION (°)

FIGURE F8


AIRCRAFT: BELL OH-58
100
75
50
25
TRANSMISSION (%)
10
20
30
40
50
60
70
80
90
ANGLE OF INCLINATION (°)
FIGURE R1

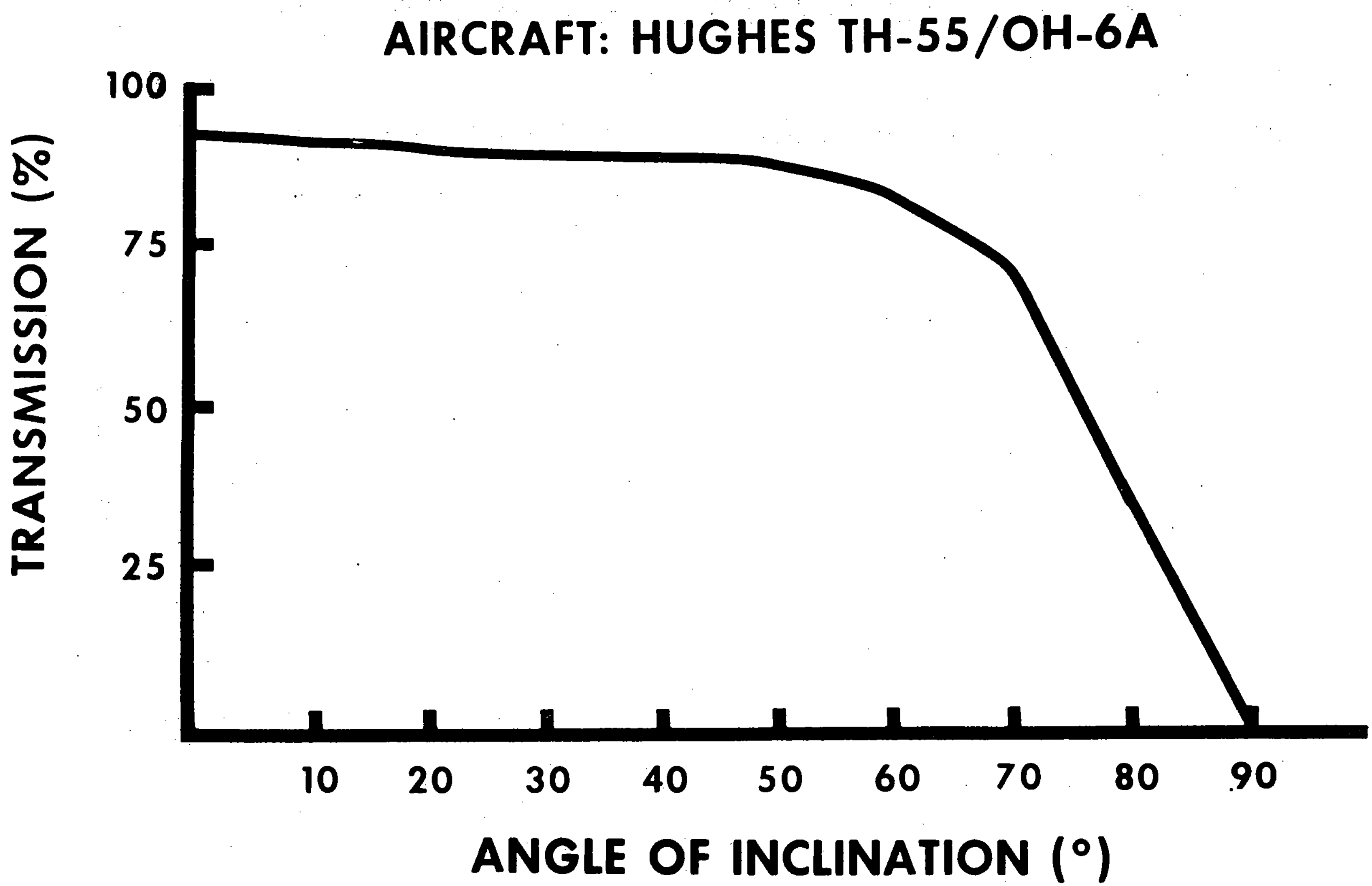
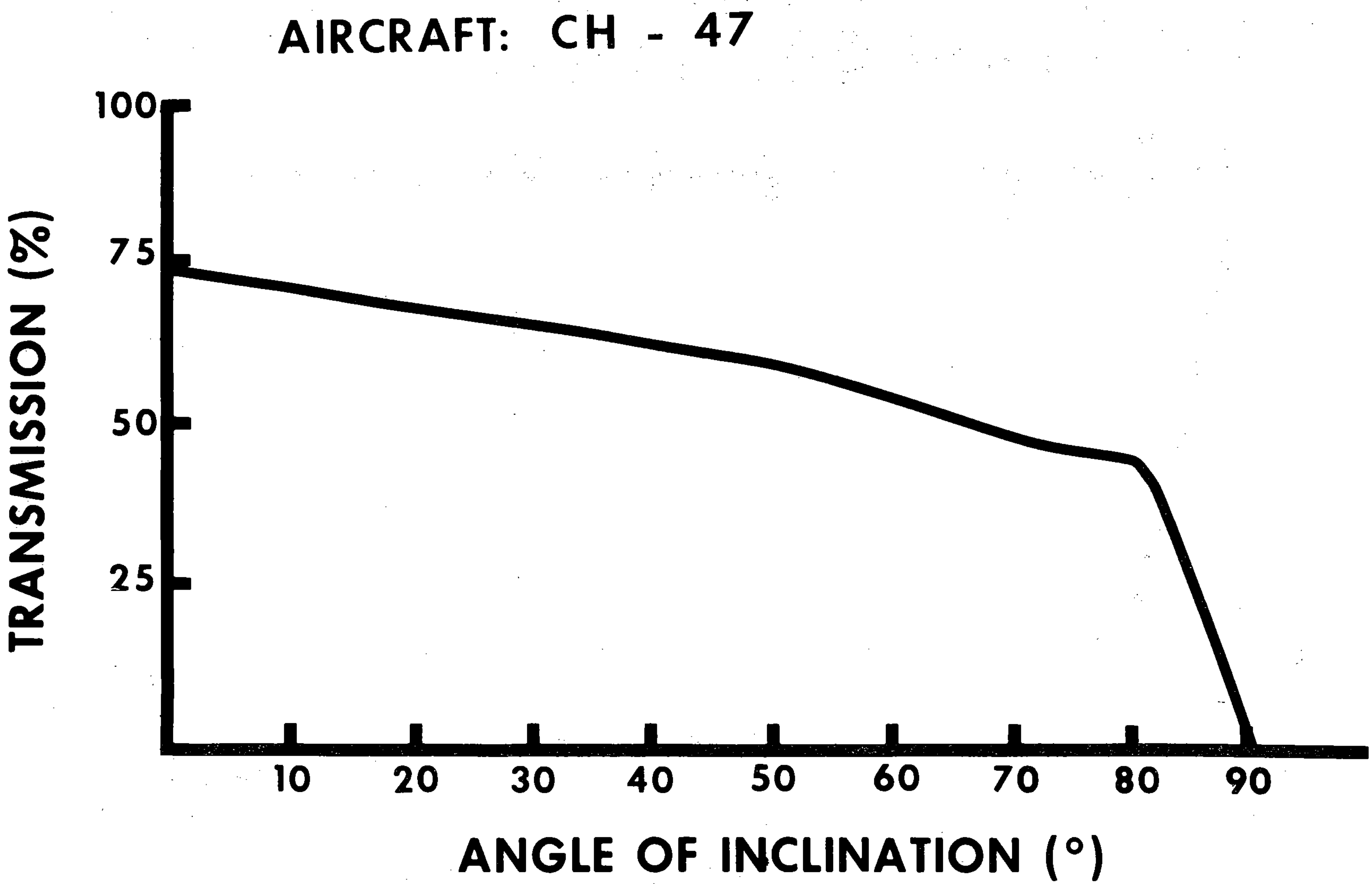

AIRCRAFT: HUGHES TH-55/OH-6A
100
75
50
25
TRANSMISSION (%)
10
20
30
40
50
60
70
80
90
ANGLE OF INCLINATION (°)

FIGURE R2



AIRCRAFT: CH - 47
100
75
50
25
TRANSMISSION (%)
10
20
30
40
50
60
70
80
90
ANGLE OF INCLINATION (°)

FIGURE R3

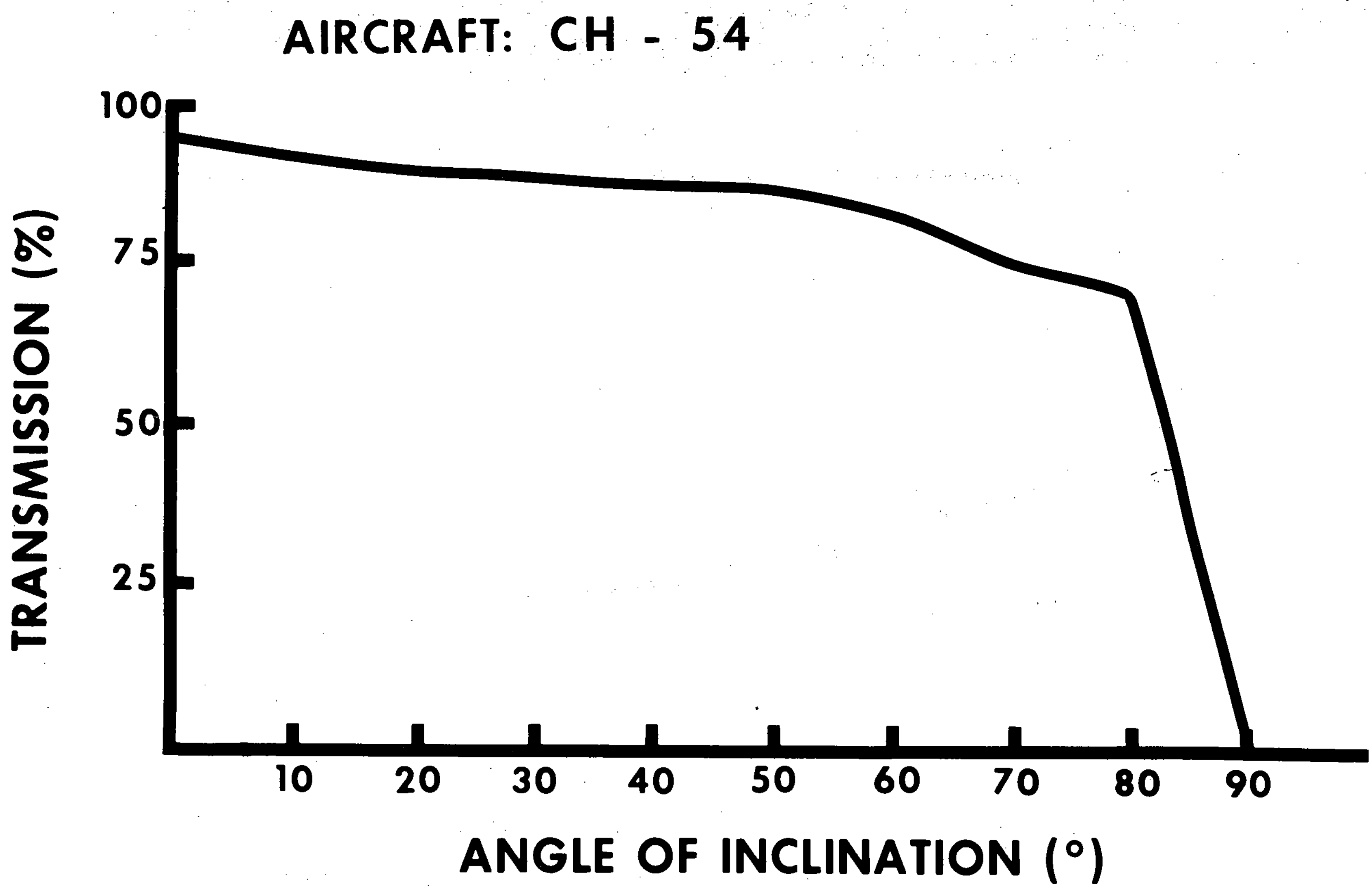

AIRCRAFT: CH - 54
TRANSMISSION (%)
100
75
50
25
10
20
30
40
50
60
70
80
90
ANGLE OF INCLINATION (°)

FIGURE R4

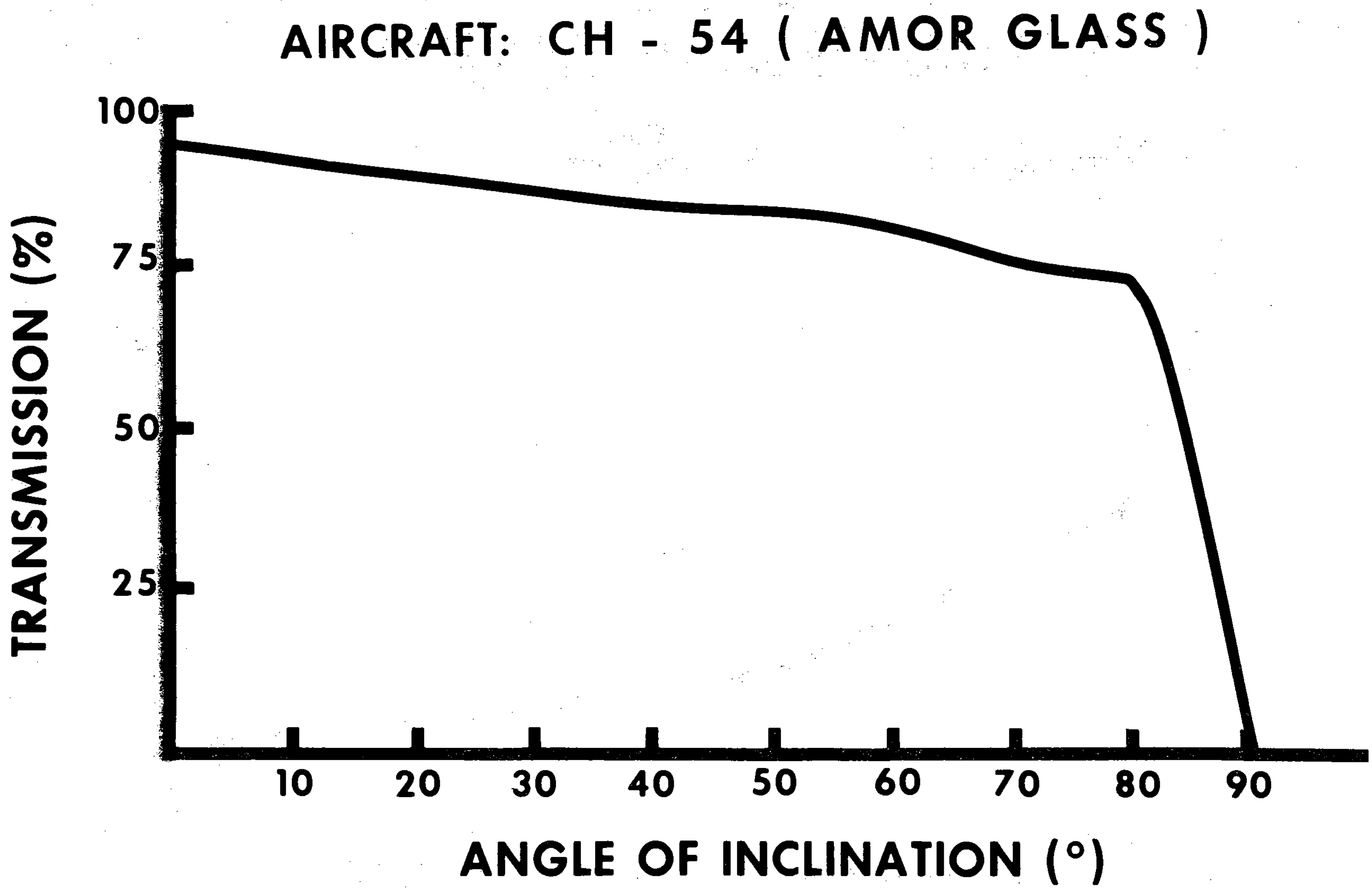

AIRCRAFT: CH - 54 (AMOR GLASS)
100
75
50
25
TRANSMISSION (%)
10
20
30
40
50
60
70
80
90
ANGLE OF INCLINATION (°)

FIGURE R5

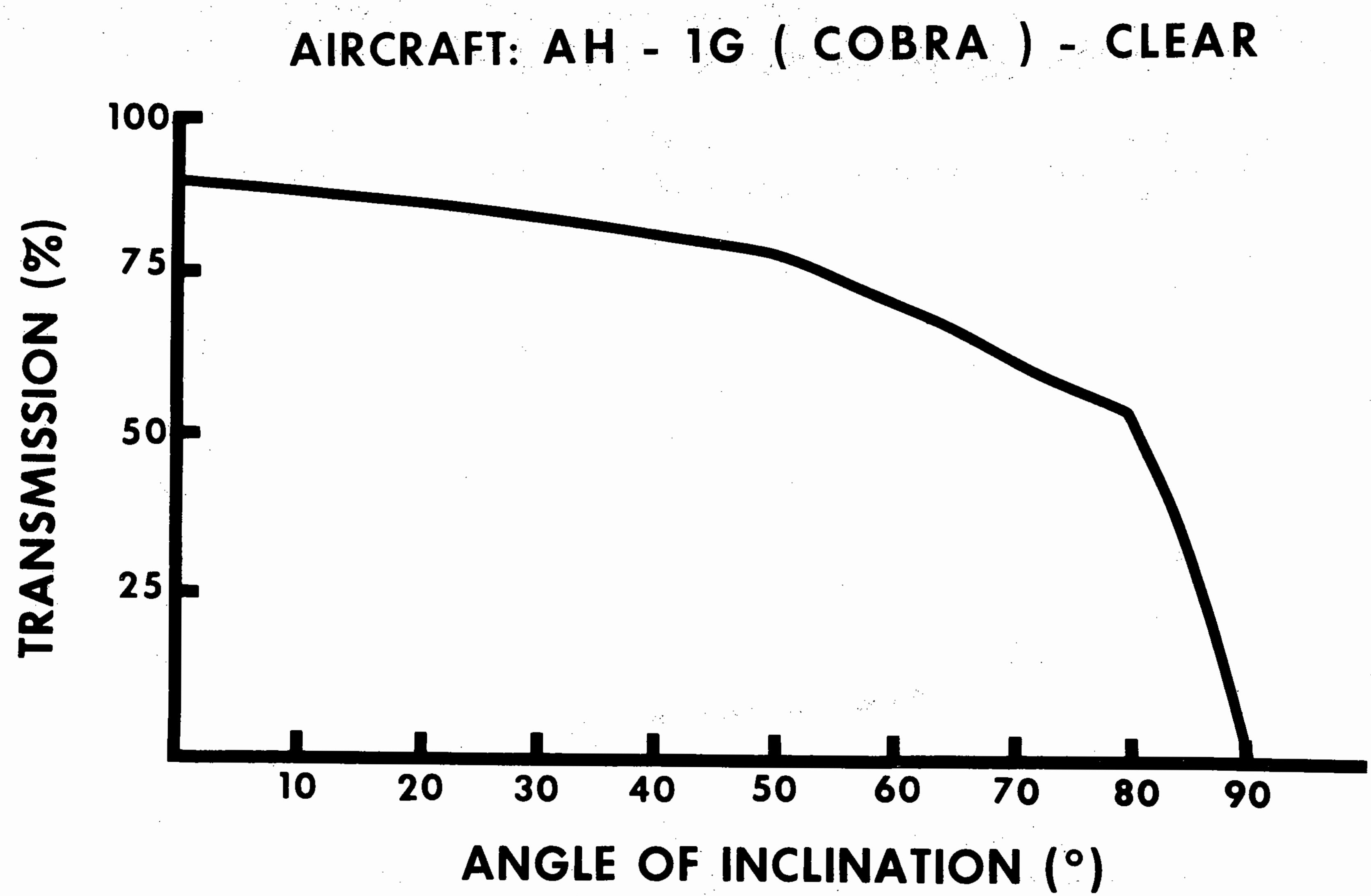

AIRCRAFT: AH - 1G (COBRA) - CLEAR
100
75
50
25
TRANSMISSION (%)
10
20
30
40
50
60
70
80
90
ANGLE OF INCLINATION (°)

FIGURE R6

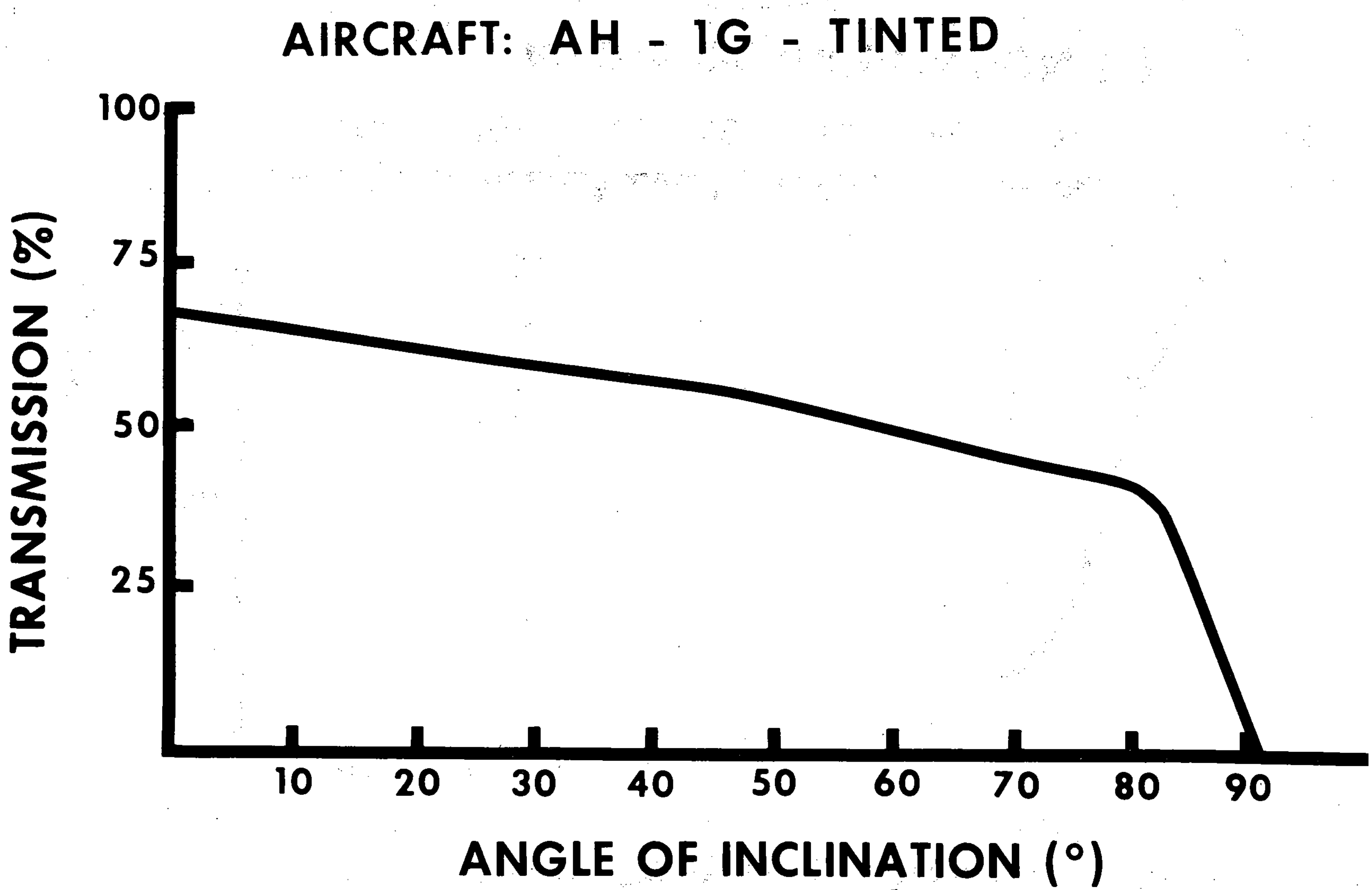

AIRCRAFT: AH - 1G - TINTED
100
75
50
25
TRANSMISSION (%)
10
20
30
40
50
60
70
80
90
ANGLE OF INCLINATION (°)

FIGURE R7

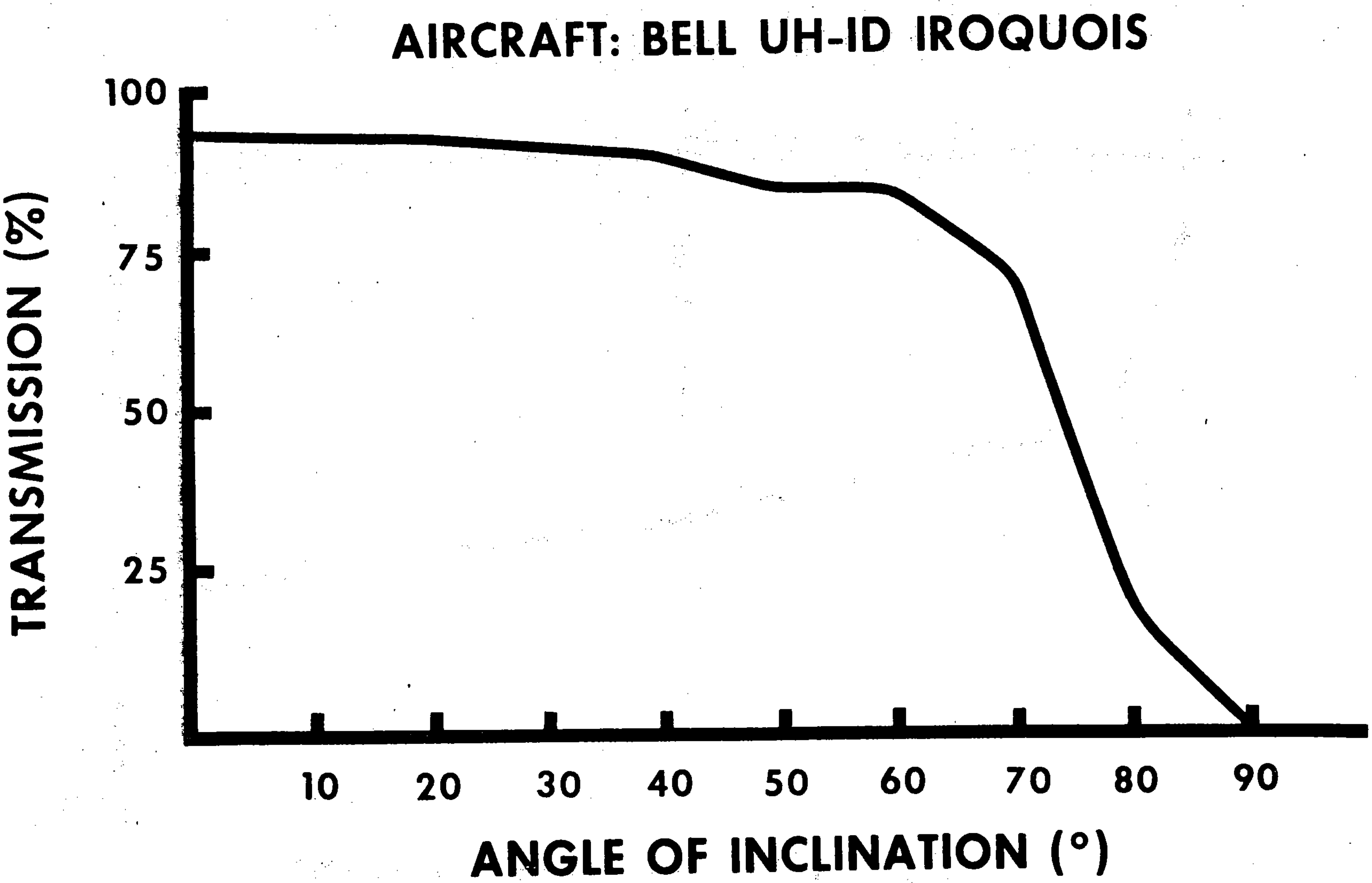

AIRCRAFT: BELL UH-ID IROQUOIS
100
75
50
25
TRANSMISSION (%)
10
20
30
40
50
60
70
80
90
ANGLE OF INCLINATION (°)

FIGURE R8

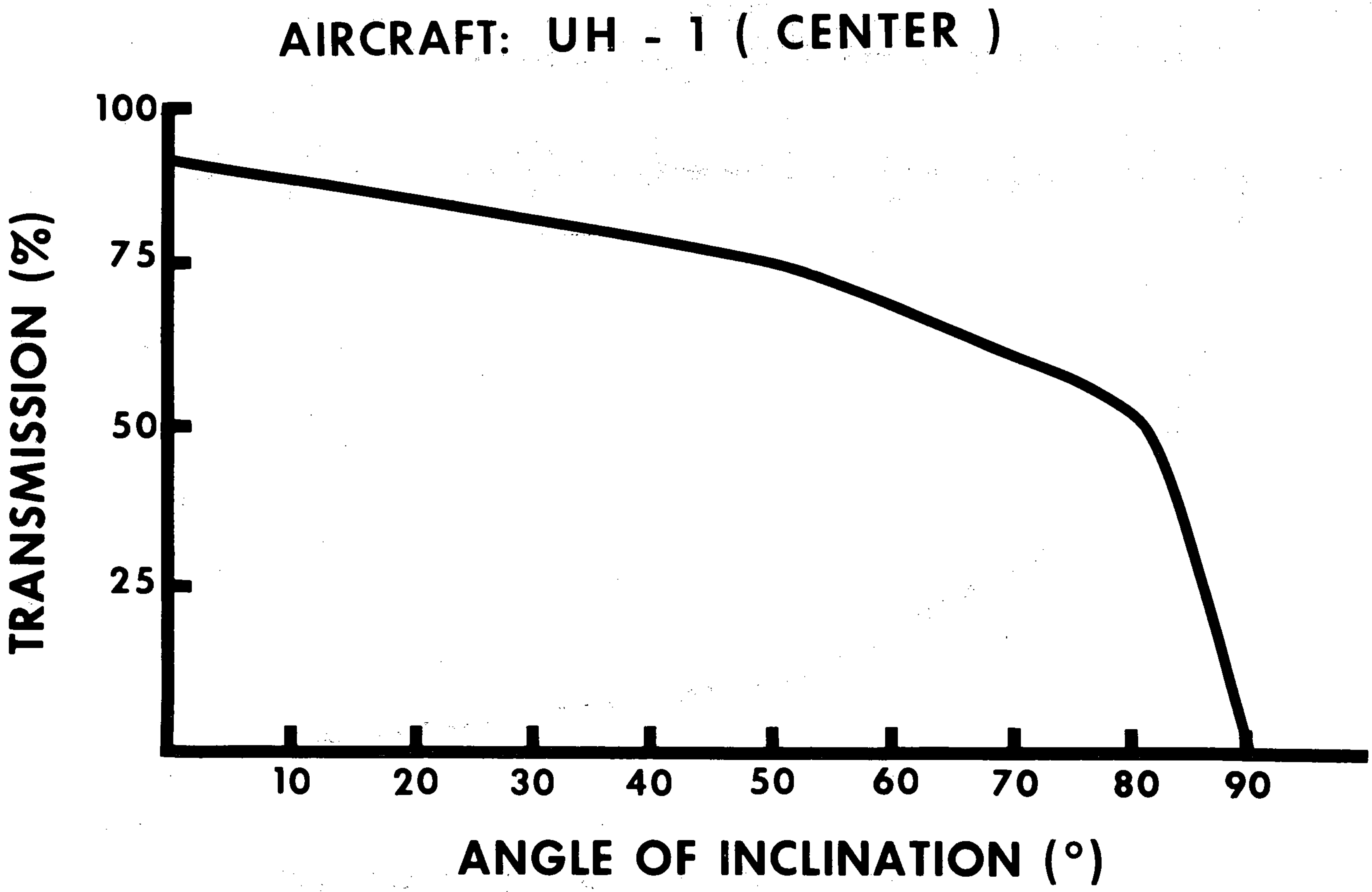

AIRCRAFT: UH - 1 (CENTER)
100
75
50
25
TRANSMISSION (%)
10
20
30
40
50
60
70
80
90
ANGLE OF INCLINATION (°)

FIGURE R9

AIRCRAFT: UH - 1 (CORNER)

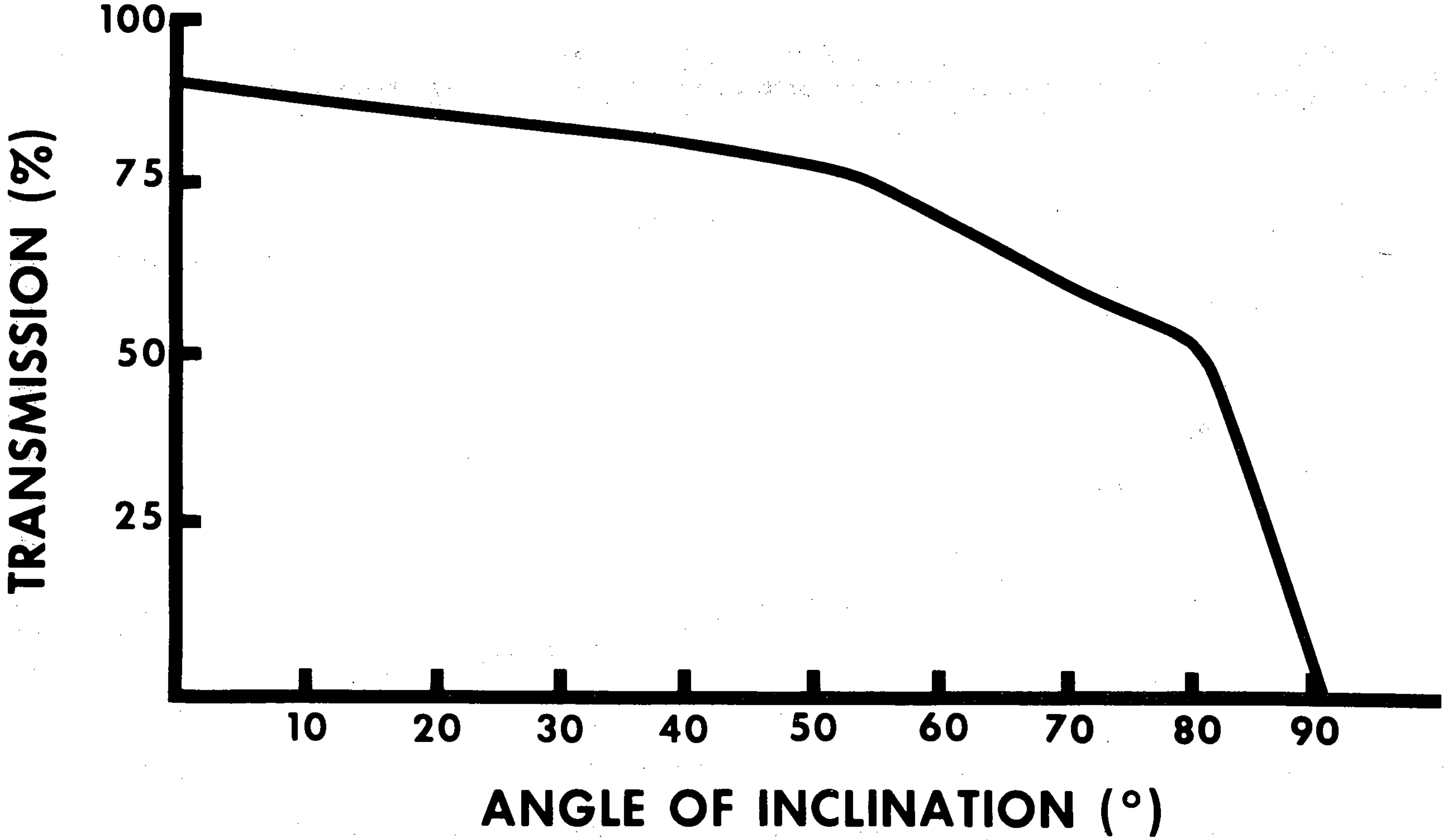


FIGURE R10

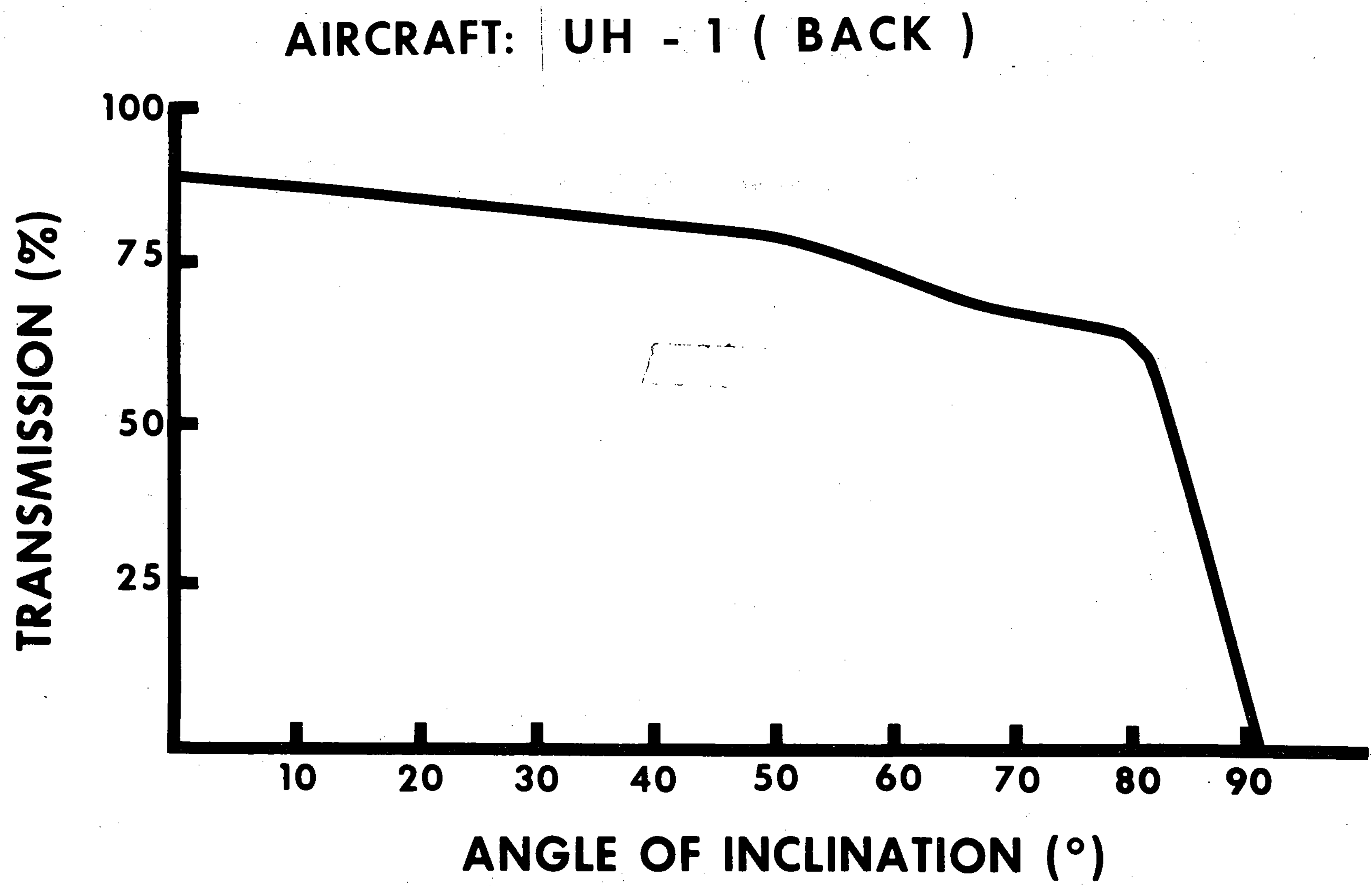

AIRCRAFT: UH - 1 (BACK)
100
75
50
25
TRANSMISSION (%)
10
20
30
40
50
60
70
80
90
ANGLE OF INCLINATION (°)

FIGURE R11

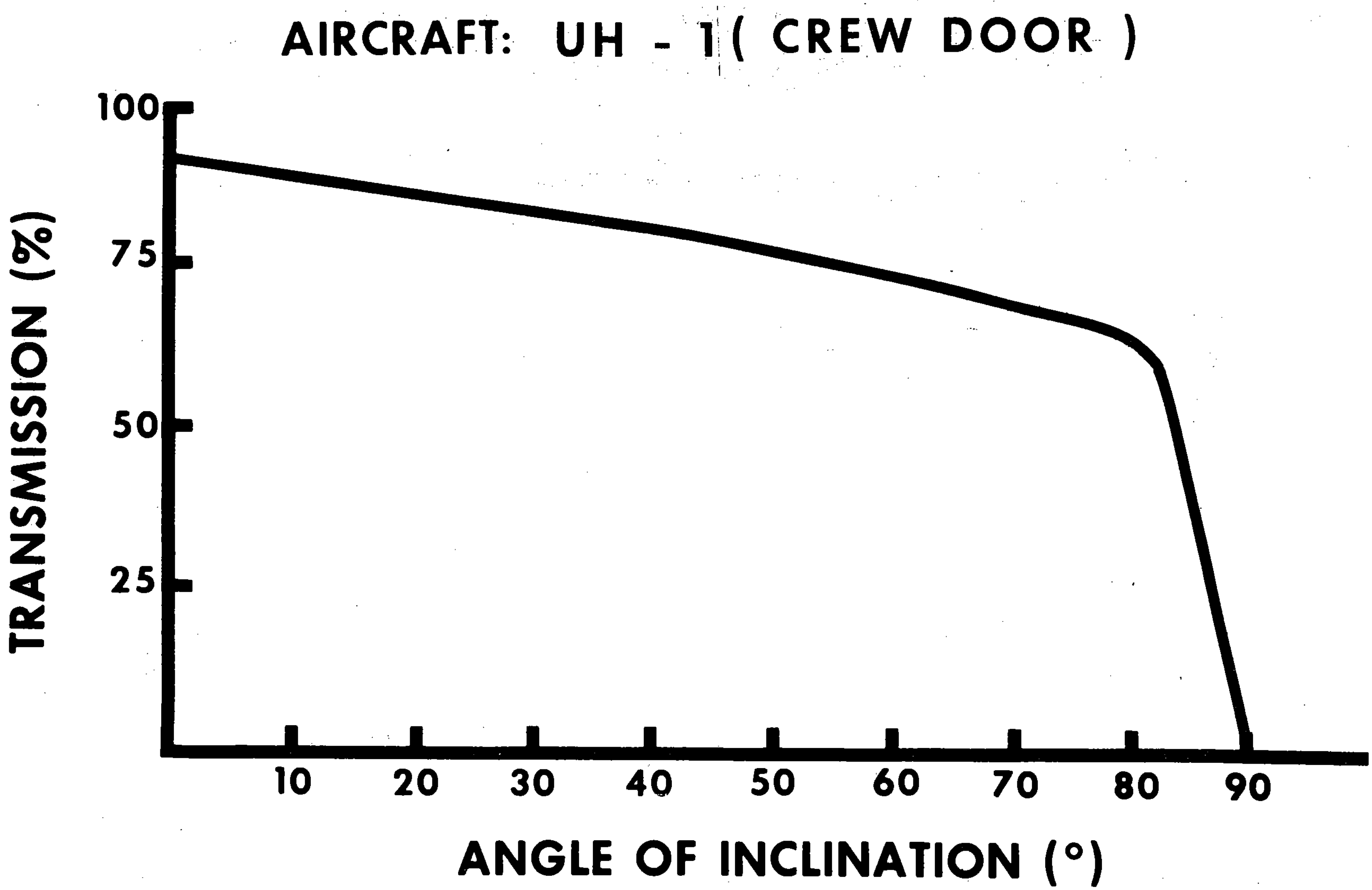

AIRCRAFT: UH - 1 (CREW DOOR)
TRANSMISSION (%)
100
75
50
25
10
20
30
40
50
60
70
80
90
ANGLE OF INCLINATION (°)

FIGURE R12

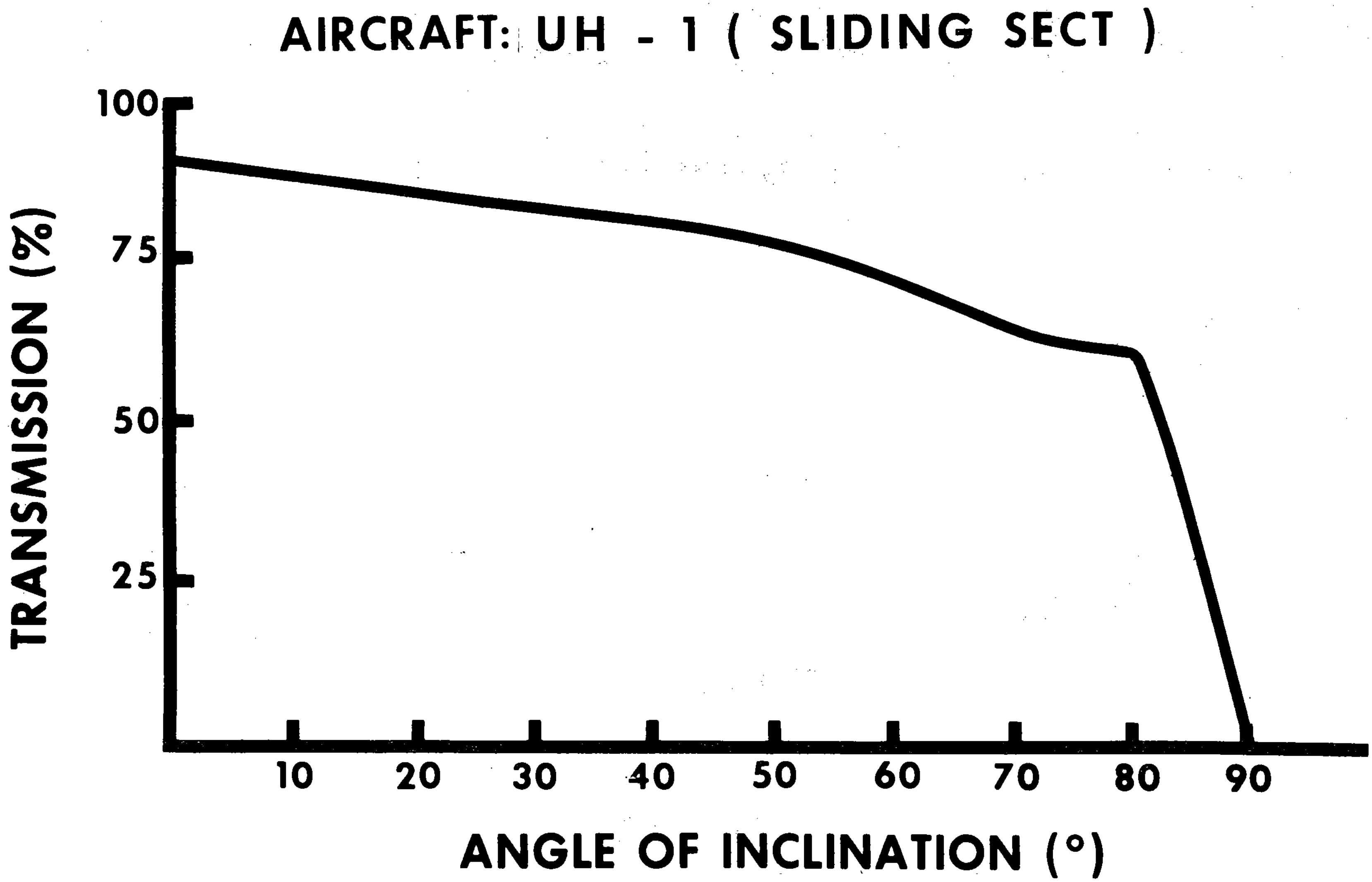

AIRCRAFT: UH - 1 (SLIDING SECT)
100
75
50
25
TRANSMISSION (%)
10
20
30
40
50
60
70
80
90
ANGLE OF INCLINATION (°)

FIGURE R13

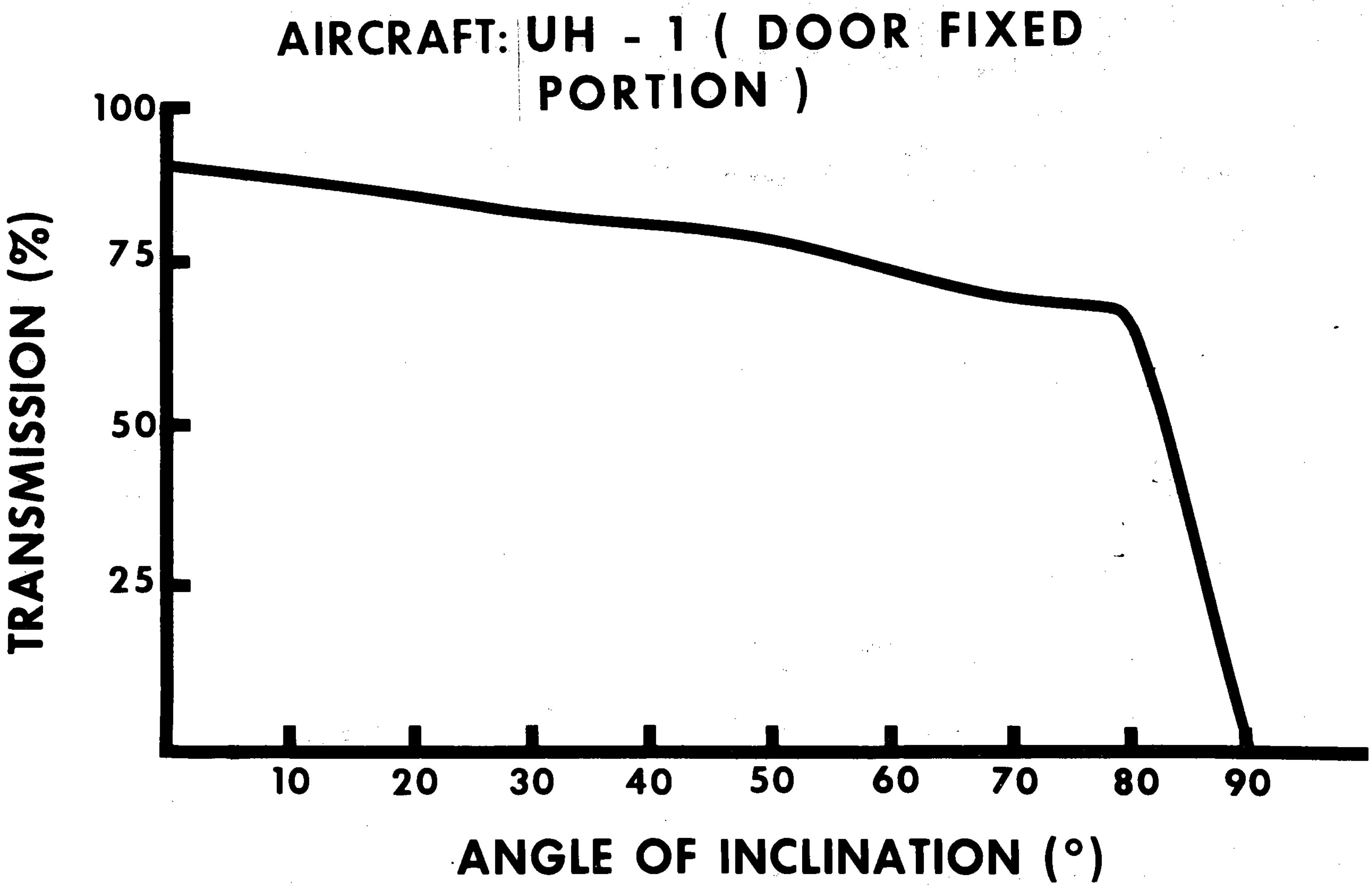

AIRCRAFT: UH - 1 (DOOR FIXED PORTION)
100
75
50
25
TRANSMISSION (%)
10
20
30
40
50
60
70
80
90
ANGLE OF INCLINATION (°)

FIGURE R14